8062A
Digital Multimeter

Instruction Manual

FLUKE

C90 CARRYING CASE (BELT)

8062A
Digital Multimeter

Instruction Manual

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SAFETY INFORMATION

This meter has been designed and tested in accordance with IEC Publication 348. To ensure that the meter is used safely, follow all safety and operating instructions in this manual. If the meter is not used as described in this manual, the safety features of the meter might be impaired.

- Do not use the meter if the meter or test leads look damaged, or if you suspect that the meter is not operating properly.
- Turn off power to the circuit under test before cutting, unsoldering, or breaking the circuit. Small amounts of current can be dangerous.
- Do not apply more than 500V rms between a terminal and earth ground.
- Use caution when working above 60V dc or 30V ac rms. Such voltages pose a shock hazard.
- When using the probes, keep your fingers behind the finger guards on the probes.
- Disconnect the live test lead before disconnecting the common test lead.

SYMBOLS

The following international symbols are used in this manual:

Important Safety Information in Manual

AC

DC

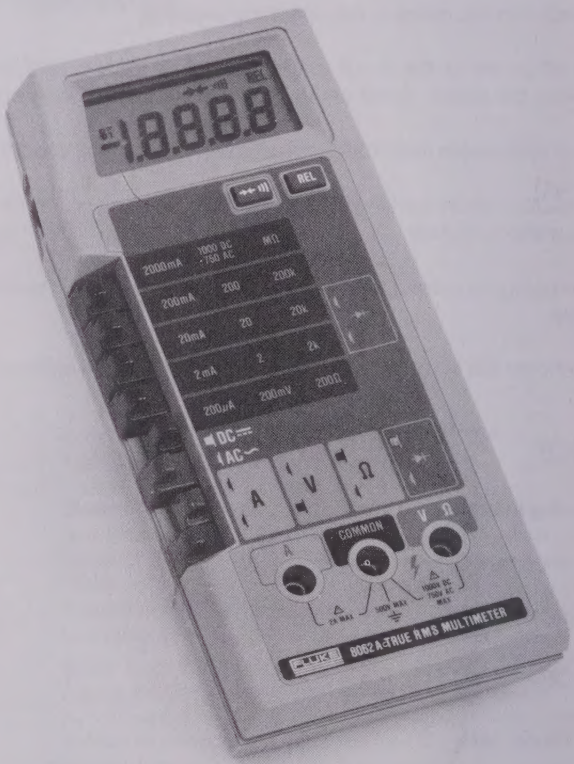
Diode Test

Ground

Fuse

Indicates Terminals At Which Dangerous Voltages May Exist

Battery



Model 8062A Digital Multimeter

Section 1
Introduction and Specifications

1-1. INTRODUCTION

Your John Fluke Model 8062A is a handheld, microcomputer-based 4-1/2 digit multimeter that is ideally suited for use in the field, laboratory, shop or home. The 8062A has features that have become accepted standards for quality handheld multimeters, as well as some new features that have not been offered before in a handheld multimeter. New features include the following:

- True rms measurements for ac signals up to 30 kHz.
- Resistance measurements up to 300 MΩ.
- Ability to store any input signal as an offset or relative reference value.

Other features include:

- FUNCTIONS:

  Standard DMM measurement functions, such as ac and dc volts and ac and dc current, as well as resistance, continuity, and diode test.

- RANGES:

  Leading zero suppression.

  Automatic polarity.

  Overrange indication.

  Protection from overloads and transients up to 6 kV.

  Dual-slope integration a/d conversion to ensure noise-free measurements.

  Autoranging MΩ resistance range (to 300 MΩ), as well as four fixed resistance ranges from 200Ω to 200 kΩ.

- OPERATOR CONVENIENCE:

  4-1/2 digit Liquid Crystal Display.

  Software-controlled self-test routines for quick verification of internal circuitry and operation.

- POWER:

  170 hours of continuous operation can be expected from a 9V alkaline battery (NEDA 1604).

  Low battery voltage is automatically detected and displayed. The low battery indication, BT, appears on the display when about 20% of the battery life remains.

  Ordinary line operation is possible using a Fluke Model A81 Battery Eliminator (refer to Section 6 for a description).

A full line of accessories is available to enhance the capabilities of the 8062A. The accessories are listed in Table 1-1 and described in Section 6.

1-2. SPECIFICATIONS

The specifications for the 8062A are listed in Table 1-2.

Table 1-1. 8062A Accessories

MODEL NO.*	DESCRIPTION
A81	Battery Eliminator
C-90	Vinyl Carrying Case
80T-150C	Temperature Probe °C
80T-150F	Temperature Probe °F
80I-600	Current Transformer 2" jaws
80K-6	High Voltage Probe (6 kV)
80K-40	High Voltage Probe (40 kV)
80J-10	Current Shunt
83RF	High Frequency Probe (100 MHz)
85RF	High Frequency Probe (500 MHz)

*BNC, banana plug, phone and phono adapters are also available as accessories and are listed in Section 6.

Table 1-2. 8062A Specifications

ELECTRICAL

The following specifications are based on a one-year calibration cycle, an operating temperature of 18 to 28°C (64 to 82°F) and a relative humidity not exceeding 90%.

DC Voltage

RANGE	RESOLUTION	ACCURACY ±(% of reading + no. of digits)
200 mV 2 V	.01 mV .1 mV	0.05% + 2
20 V 200 V 1000 V	1 mV 10 mV 100 mV	0.07% + 2

RESPONSE TIME ..... 1 second maximum, to rated accuracy within selected range.

INPUT IMPEDANCE ..... 10 MΩ shunted by <100 pf

NORMAL MODE NOISE REJECTION ..... >60 db at 50 Hz or 60 Hz

COMMON MODE NOISE REJECTION ..... >120 dB at dc, >90 dB at 50 Hz and 60 Hz (1 kΩ imbalance)

OVERLOAD PROTECTION ..... 1000V dc or peak ac continuous, except 20 seconds maximum on 200 mV and 2V ranges above 300V dc or rms.

DC Voltage, High Impedance Mode

All specifications are the same as for the dc voltage mode except the following (only 200 mV and 2V ranges are available):

RANGE	RESOLUTION	ACCURACY ±(% of reading + no. of digits)
200 mV 2V	.01 mV .1 mV	0.06% + 2

INPUT IMPEDANCE ..... >1000 MΩ, typically >10,000 MΩ

OVERLOAD PROTECTION ..... 300V dc or rms continuous, 20 seconds maximum 300V to 1000V dc or peak ac.

Table 1-2. 8062A Specifications (cont)

AC Voltage (True RMS, AC-Coupled)

RANGES ..... 200 mV, 2V, 20V, 200V, 750V

ACCURACY ..... ±(% of reading + no. of digits). See table below:

<table>
<tr><th>INPUT VOLTAGE</th><th>RESO-LUTION</th><th>RANGE</th><th>20 Hz to 45 Hz</th><th>45 Hz to 500 Hz</th><th>500 Hz to 10 kHz</th><th>10 kHz to 30 kHz</th></tr>
<tr><td>10.0 to 199.99 mV</td><td>.01 mV</td><td>200 mV</td><td rowspan="4">1% +10</td><td rowspan="4">0.5% +10</td><td rowspan="2">0.5% +20</td><td rowspan="2">1% +40</td></tr>
<tr><td>.1000 to 1.9999V</td><td>.1 mV</td><td>2V</td></tr>
<tr><td>1.000 to 19.999V</td><td>1 mV</td><td>20V</td><td rowspan="2">5% +20</td><td rowspan="2">5% +40</td></tr>
<tr><td>10.00 to 199.99V</td><td>10 mV</td><td>200V</td></tr>
<tr><td>100.0 to 499.9V</td><td rowspan="2">100 mV</td><td rowspan="2">750V</td><td rowspan="2">Not Specified</td><td>1%+10</td><td rowspan="2">Not Specified</td></tr>
<tr><td>500.0V to 750.0V</td><td>2%+10</td></tr>
</table>

1 kHz

INPUT IMPEDANCE ..... 10 MΩ shunted by <100 pF

COMMON MODE NOISE REJECTION ..... >60 dB at 50 Hz and 60 Hz (1 kΩ imbalance)

CREST FACTOR RANGE . 1:1 to 3:1

RESPONSE TIME ..... Five seconds maximum to rated accuracy within selected range, 12 seconds to rated accuracy from an overload.

OVERLOAD PROTECTION ..... 750V rms or 1000V peak continuous except 20 seconds maximum on the 200 mV range above 300V rms or 300V dc. Input not to exceed a volt-hertz product of $1x10^7$ (for example, 200V at 50 kHz).

Table 1-2. 8062A Specifications (cont)

Resistance

RANGES ..... 200Ω, 2 kΩ, 20 kΩ, 200 kΩ, autoranging MΩ. The MΩ range extends from .0001 MΩ to 300 MΩ in three autoranged ranges. Upscale range changes are made at 2 MΩ and 20 MΩ. Downscale range changes are made at 19 MΩ and 1.9 MΩ.

ACCURACY ..... ±(% of reading + no. of digits). See table below.

RANGE		RESOLUTION	ACCURACY	FULL-SCALE VOLTAGE	MAX CURRENT	OPEN CIRCUIT VOLTAGE
200Ω		0.01Ω	(0.1%+2+.02Ω)	<250 mV	<1.1 mA	<4.8V
2 kΩ		0.1Ω	(0.1%+2)		<150 μA	
20 kΩ		1Ω	(0.1%+2)		<15 μA	<1.5V
200 kΩ		10Ω	(0.1%+2)		<1.5 μA	
MΩ	0-1.9999 MΩ	100Ω	(0.2%+2)	<2.5V	<2.5 μA	<2.5V
	2-19.99 MΩ	10 kΩ	(0.25%+3)			
	20-99.9 MΩ	100 kΩ	(1%+3)			
	100-300 MΩ	1 MΩ	(2%+3)			
AUTORANGING KΩ		0.1Ω TO 1 kΩ	(.20% +5)		<1.0 mA	

RESPONSE TIME ..... Two seconds maximum to rated accuracy for all ranges except MΩ. For MΩ, 8 seconds maximum.

OVERLOAD PROTECTION ..... 500V dc or rms ac for all ranges.

Table 1-2. 8062A Specifications (cont)

Continuity

RANGES ..... All resistance ranges

THRESHOLD ..... Nominally <50% of range (for example, <100Ω in the 200Ω range) for 200Ω, 2 kΩ, 20 kΩ, 200 kΩ ranges. Nominally <100 kΩ in MΩ range and <100Ω in autoranging kΩ.

DISPLAY INDICATION ... Horizontal bar across the top of the display and/or 2.667 kHz tone. Indication is present for a minimum of 200 ms.

RESPONSE TIME ..... 50 μs maximum (10 μs typical)

OVERLOAD PROTECTION ..... 500V dc or rms ac

Diode Test

RANGE 2V

TEST CURRENT ..... 1 mA (Typical)

ACCURACY ..... ±(0.06% of reading + 2 digits) (Specification applies for voltage measurement)

RESPONSE TIME ..... 1 second maximum

OVERLOAD PROTECTION ..... 500V dc or rms ac

DC Current

RANGE	RESOLUTION	ACCURACY ±(% of reading + no. of digits)	BURDEN VOLTAGE
200 μA	.01 μA	0.3% + 2	.3V typical
2 mA	.1 μA		.3V typical
20 mA	1 μA		.3V typical
200 mA	10 μA	0.7% + 2	.3V typical
2000 mA	100 μA		.9V typical

OVERLOAD PROTECTION ..... 2A/250V fuse (operator replaceable) in series with 3A/600V fuse (service personnel replaceable).

Table 1-2. 8062A Specifications (cont)

AC Current (True RMS Responding, AC-Coupled

ACCURACY ..... ±(% of reading + no. of digits). See table below:

INPUT CURRENT	RESOLUTION	RANGE	20 Hz to 45 Hz	45 Hz to 3 kHz	3 kHz to 10 kHz	10 kHz to 30 kHz
.10 to 199.99 μA	0.01 μA	200 μA	1%+10	0.75% +10	2% +20	2% +40
.1 to 1.9999 mA	0.1 μA	2 mA				
1 to 19.999 mA	1 μA	20 mA				
10 to 199.99 mA	10 μA	200 mA	1.5% +10	1% +10	Not Specified	
100 to 1999.9 mA	100 μA	2000 mA				

BURDEN VOLTAGE ..... 0.3V rms typical except 2000 mA range, 0.9V rms typical.

OVERLOAD PROTECTION ..... 2A/250V fuse (operator replaceable) in series with 3A/600V fuse (service personnel replaceable).

Relative

SELECTION ..... When the REL button is pushed, the input applied at that time is stored as a zero reference point. Subsequent readings indicate deviations (±) from the reference point.

ACCURACY ..... Error does not exceed the sum of the errors of the reference reading and the subsequent reading.

Table 1-2. 8062A Specifications (cont)

GENERAL	
Maximum Common Mode Voltage	500V dc or ac rms
Display Update Rate	2.5 readings/second.
Display	4½ digit duplex LCD (19,999 count), leading zero suppression, autopolarity.
Display Annunciators	BT (low battery indicator). REL (relative function enabled). ⊣⊢ and))) (continuity function enabled), and ▬ (bar indicates continuity detected).
A/D Converter	Dual-slope converter
Power	Single standard 9V battery (NEDA 1604), or Fluke A-81 Battery Eliminator option available for 100, 115, or 230V ac operation.
Battery Life	Typically 170 hours with an alkaline battery. BT appears on display when approximately 20% of battery life remains.
Size	180 mm L x 86 mm W x 45 mm H (7.1" L x 3.4" W x 1.8" H)
Weight	.41 kg (14.5 oz.)
Shock and Vibration	MIL-T-28800B
ENVIRONMENTAL	
Operating Temperature	0 to 50°C
Storage Temperature	-35 to +60°C
Accuracy Temperature Coefficient	0.1 x the applicable accuracy specification per °C (plus the initial 23°C specification) for 0 to 18°C and 28 to 50°C.
Relative Humidity	0 to 80% R.H. from 0 to +35°C, 0 to 70% from 35 to 50°C, except 0 to 70% R.H. for MΩ range above 20 MΩ.
SAFETY	
Safety Standards	Designed to Protection Class II requirements of IEC 348, UL1244 ANSI C39.5, and CSA Bulletin 556B.

Section 2
Operating Instructions

2-1. INTRODUCTION

This section describes how to make measurements with your 8062A. Even though you may have used a multimeter before, we suggest that you take the time to read this material carefully so that you can take full advantage of the wide variety of measurement functions offered by the 8062A.

2-2. UNPACKING YOUR INSTRUMENT

Your instrument was shipped with two test leads (one red and one black), a 9V battery, and this manual. Check the shipment carefully and immediately contact the place of purchase if anything is missing or damaged in shipment.

If reshipment is necessary, please use the original shipping container. If the original container is not available, be sure that adequate protection is provided to prevent damage during shipment. It is recommended that the instrument be surrounded by at least three inches of shock-absorbing material in the shipping container.

2-3. BATTERY INSTALLATION OR REPLACEMENT

The 8062A is designed to operate on a single, common, inexpensive 9V battery (NEDA 1604). When you receive the instrument, the battery will not be installed. Once the battery is installed, you can expect a typical operating life of up to 170 hours with an alkaline battery, or 80 hours with a carbon-zinc battery. When the battery has exhausted about 80% of its useful life the BT indicator will appear at the far left of the display. Your instrument will continue to operate properly for at least 24 hours with an alkaline battery after BT first appears on the display. The 8062A also may be operated from a standard ac power line outlet when used with the optional A81 Battery Eliminator (refer to Section 6 for a description). Use the following procedure to install or replace the battery:

WARNING

TO AVOID ELECTRICAL SHOCK, TURN OFF THE INSTRUMENT AND REMOVE THE TEST LEADS AND ANY INPUT SIGNALS BEFORE REPLACING THE BATTERY.

1. Set the 8062A power switch to OFF.

2. Remove test leads from external connections and from the 8062A input terminals.

3. Turn the instrument over and use your thumbs to pry off the battery cover as shown in Figure 2-1 (push cover down and then out).

4. Slide the battery out of the compartment as shown in Figure 2-2.

5. Carefully pull the battery clip free from the battery terminals (if replacing the battery) and attach the new battery.

6. Slide the battery and its leads into the compartment and slide the cover into place.

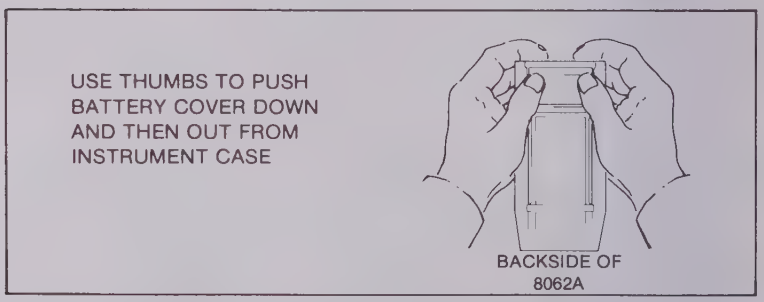


Figure 2-1. Removal of Battery Compartment Cover

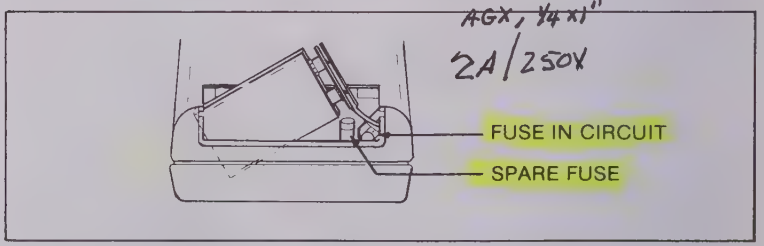


Figure 2-2. Battery Removal and Fuses

You can measure the voltage of your battery by using the following procedure:

1. Select the dc voltage function and the 20V range.

2. Locate the opening for the battery eliminator jack on the right side of the instrument to the right of the display. Touch the red (VΩS) probe tip

to the side contact (not the center pin). Be sure you do not short the battery by shorting the side contact to the center pin. Battery voltage should be between 5.2V to 10V for proper operation. If the voltage is less, the battery should be replaced.

2-4. FUSE REPLACEMENT

When you installed the battery, you probably noticed two fuses at the right side of the battery compartment (refer to Figure 2-2 or examine your instrument). The fuse at the far right is F1. Fuse F1, 2A/250V, protects the current input from an input overload. The other fuse is a spare fuse for F1. When you purchase your instrument, F1 should be installed and the spare fuse should be in one of the two slots next to it. The larger slot is for the American-style fuse, and the smaller slot is for the European-style fuse (either style fuse fits in the installation compartment).

If you need to replace F1, use the tip of a test lead to push the fuse forward from the end and then up to release. Replace F1 with the appropriate 2A/250V fuse; American-style: fast-acting, type AGX2, 1/4 x 1", Fluke PN 376582; European-style: 5 x 20 mm, Fluke PN 460972. Do not use makeshift fuses or short-circuit the fuseholder.

There is another fuse, F2, 3A/600V, which also protects the current input. The instrument cover must be removed to replace F2. This procedure is described in Section 4 and should only be done by a person qualified to service the instrument.

The following steps provide a quick and easy way to ckeck the condition of both fuses F1 and F2:

1. Select the resistance function and the 2 kΩ range.

2. Touch the red test lead tip to the A input jack so that the VΩS input and the A input are shorted together.

3. If the display reads .1000 ± .0100 kΩ, both fuses are good.

4. If the display reads OL, one or both fuses need replacement.

2-5. PHYSICAL FEATURES

Before you begin using your 8062A, we suggest you take a few minutes to familiarize yourself with the instrument. All of the externally accessible features are shown in Figure 2-3 and described in Table 2-1. The front panel and the display are also described in the following paragraphs.

2-6. Front Panel

The front panel of the 8062A is designed to make function and range selection easy. The symbols and colors on the panel indicate which switches to push or buttons to press to select the function you want. Details are provided later with the description of each function.

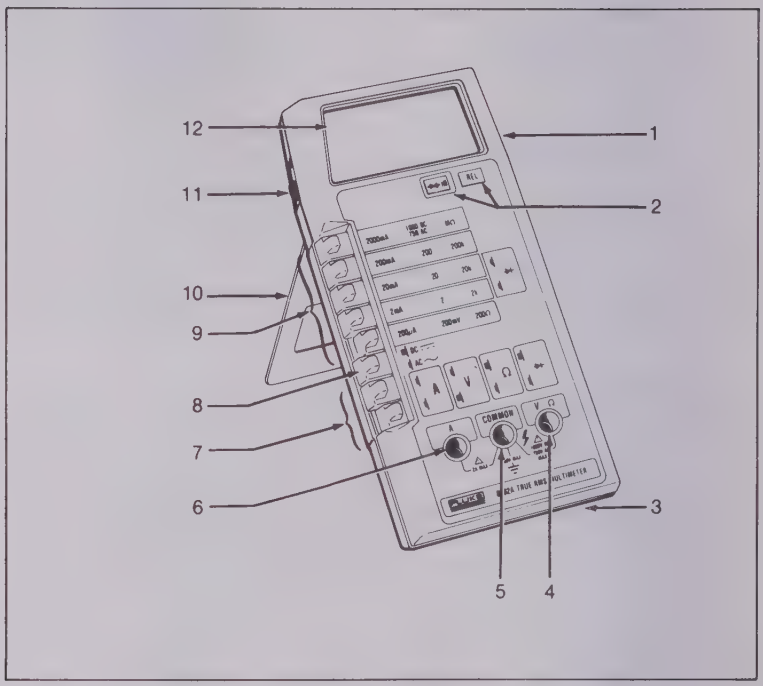


Figure 2-3. Controls, Indicators and Connectors

Table 2-1. Controls, Indicators and Connectors

ITEM NO.	NAME	FUNCTION
1	Battery Eliminator Connector	External input power connector for use with the A81 Battery Eliminator accessory.
2	Function Buttons: ⊷))), REL	Push buttons that toggle on or toggle off the 'secondary' functions: visible or audible continuity, or relative. These functions are selected in conjunction with the primary measurement functions (see items 7 and 8).
3	Battery Compartment and Cover	Cover for the 9V battery and the current fuse F1.

Table 2-1. Controls, Indicators and Connectors (cont)

ITEM NO.	NAME	FUNCTION
4	VΩ Input Connector	Protected test lead connector used as the high input for all voltage, resistance, and continuity measurements. All test lead connectors accept standard or safety-designed banana plugs.
5	COMMON Input Connector	Protected test lead connector used as the low or common input for all measurements.
6	A Input Connector	Protected test lead connector used as the high input for current measurements.
7	Function Switches: A,V,Ω	Interlocked switches that are used in conjunction with the input connectors to select the measurement functions. Pushing one switch releases the other, or both may be pushed together.
8	AC/DC Function Switch	Push-on/push-off switch is used to select ac or dc for current or voltage measurements. (Does not affect selection of diode test or resistance functions).
9	Range Switches	Interlocked switches that are used to select ranges. Pushing a switch selects the corresponding range and releases other switch depressions. Also used to select conductance and the diode test.
10	Tilt Bail	A fold-out stand. The bail may also be removed (press in one of the legs at the hinge of the bail) and reinserted from the top as a hook for hanging the instrument.
11	Power Switch	Slide switch for turning instrument on or off.
12	Display	4½ digit LCD display (19999 maximum) with decimal point, minus sign, overrange, continuity and relative indicators.

2-7. Display

The 8062A provides measurement results on the 4-1/2 digit LCD display (refer to Figure 2-4 or your instrument). The decimal point is placed automatically. Symbols in the upper portion of the display indicate when one of the secondary functions is enabled. The measurement units are indicated by the range switch that is pushed in. Leading zeroes are not displayed.

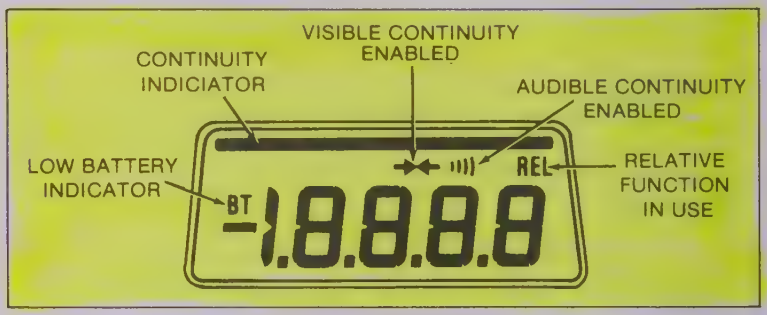


Figure 2-4. 8062A Display

If you are taking a measurement and the OL symbol appears on the display (Figure 2-5), an overrange condition is indicated, meaning that the input is higher than the range selected. You should select a higher range for the measurement. The OL symbol does not necessarily mean that the instrument is being exposed to a damaging input condition. For example, when measuring resistance, an open input will cause OL to appear.

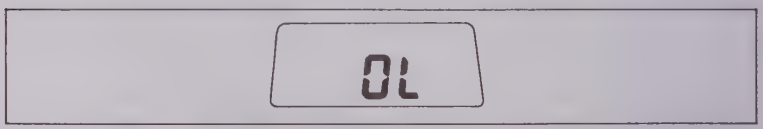


Figure 2-5. Overrange Indicator

2-8. SIGNAL INPUT LIMITS

CAUTION

Exceeding the maximum input overload limits can damage your instrument.

Before you begin to use your 8062A, it is important to note the maximum inputs that may be applied to the instrument. Table 2-2 presents the maximum inputs that are allowed for each function, range, and input terminal.

WARNING

TO AVOID ELECTRICAL SHOCK AND/OR INSTRUMENT DAMAGE, DO NOT CONNECT THE COMMON INPUT TERMINAL TO ANY SOURCE MORE THAN 500 VOLTS DC OR RMS AC ABOVE EARTH GROUND.

Table 2-2. Input Overload Limits

FUNCTION	INPUT TERMINALS	MAXIMUM INPUT LIMIT
AC Voltage	VΩ and COMMON	750V rms or 1000V peak continuous except 20 seconds maximum on the 200 mV range above 300V dc or ac rms.
DC Voltage	VΩ and COMMON	1000V dc or peak ac continuous except 20 seconds maximum on the 200 mV and 2V ranges above 300V dc or ac rms.
AC or DC Current	A and COMMON	2A maximum, fuse protected to 600V dc or ac rms.
Resistance, Diode Test, and Continuity	VΩ and COMMON	500V dc or ac rms

2-9. OPERATION

The following paragraphs describe the power-on self-test, and how to operate your 8062A in each of the seven primary functions or the two secondary functions.

2-10. Power-On Self-Test

To turn on your instrument, locate the green switch on the left side of the instrument and slide it forward. Whenever you turn on the instrument, the 8062A automatically performs a self-test to make sure the display and the microcomputer are functioning properly. If everything is functioning properly, all the LCD segments in the display will turn on (Figure 2-4). After about one or two seconds, the display will go blank briefly before responding to switch selections.

If the LCD segments do not all turn on during the self-test, or if the instrument does not clear the display after the test and then respond to switch selections, something is probably wrong with the instrument. Try the test again, and if it fails, have a qualified person refer to Section 4. If there is no display when you turn on the instrument, check the battery and battery connections. You will find that if you turn off your instrument and then immediately turn it back on, a random assortment of LCD segments may be displayed. This is normal. After about a second the instrument should turn on all the LCD segments as usual during the self-test.

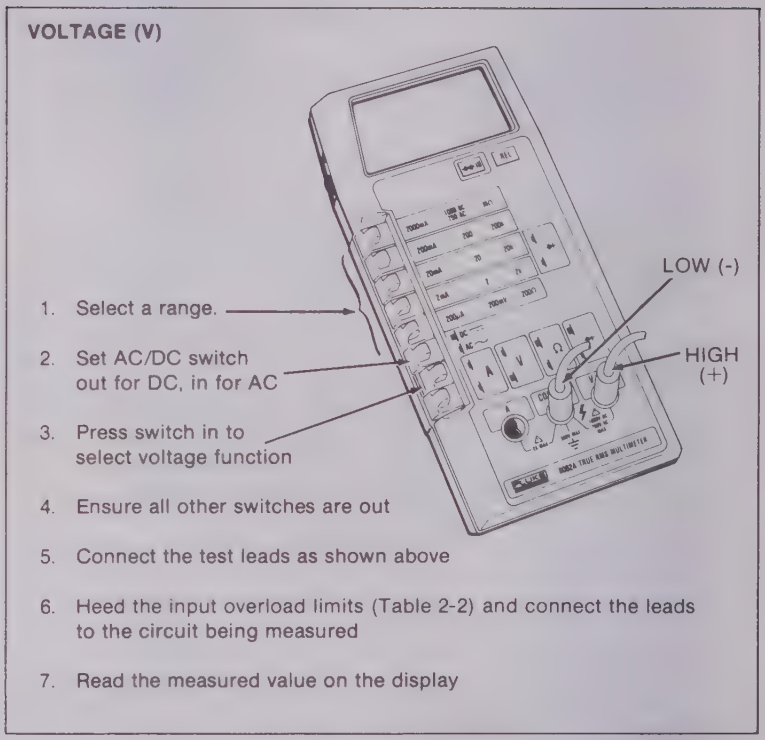

VOLTAGE (V)
LOW (-)
HIGH (+)
1. Select a range.
2. Set AC/DC switch out for DC, in for AC
3. Press switch in to select voltage function
4. Ensure all other switches are out
5. Connect the test leads as shown above
6. Heed the input overload limits (Table 2-2) and connect the leads to the circuit being measured
7. Read the measured value on the display

Figure 2-6. Voltage Operation

2-11. AC/DC Voltage (V)

Selection of the ac or dc voltage (V) functions is described in Figure 2-6. The 8062A offers five ac and five dc voltage ranges: 200 mV, 2V, 20V, 200V, and 750V ac/1000V dc. All ranges present a 10 MΩ input impedance, which is shunted by <100 pF.

2-12. TRUE RMS MEASUREMENT

One of the most useful features of the 8062A is the direct measurement of true rms or effective ac voltages and ac currents. Mathematically, rms is defined as the square root of the sum of the squares of the ac and dc components. In physical terms, rms is equivalent to the dc value that dissipates the same amount of heat in a resistor as the original waveform. The reason that rms is so valuable is that it greatly simplifies the analysis of complex ac signals. Since rms is the dc equivalent to the original waveform, it can be used in the relationships derived from Ohm's law ($E = I \times R$), and it provides a reliable basis for comparing dissimilar waveforms.

Most meters in use today have average-responding ac converters rather than true rms ac converters like the 8062A. Usually the gain in average-responding meters is adjusted so that the reading gives the rms value, provided the input signal is a harmonic-free sinusoid. However, if the signal is not sinusoidal, the average-responding meter does not give correct rms readings.

The 8062A ac converter actually calculates the rms value through analog computation. This means that 8062A readings are accurate rms values not only for harmonic-free sinusoids, but also for mixed frequencies, modulated signals, square waves, sawtooths, 10%-duty-cycle rectangular pulses, etc.

2-13. AC-COUPLED AC MEASUREMENTS

Input signals are ac-coupled in the ac functions. One of the major advantages of ac-coupling is that ripple measurements can be made on power supplies, phone lines, etc. Ripple measurements cannot be made with dc-coupling. Remember, however, that when the 8062A measures signals with the ac voltage function, the reading on the display does not include the dc component (if it exists). For example, consider the waveform in Figure 2-7. The ac voltage function will measure the ac rms component. The dc voltage function will measure the dc component. To obtain the total rms value for such a waveform, first measure the ac and dc values separately, then calculate the total rms value using the formula given in Figure 2-7.

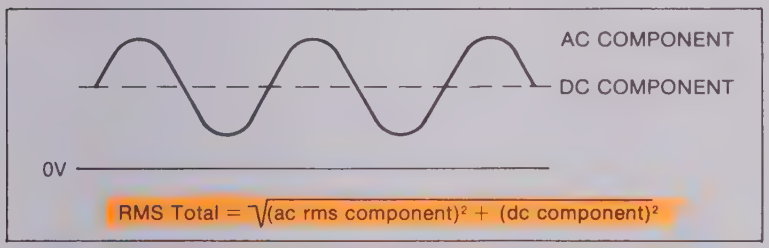
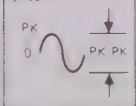
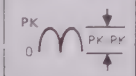
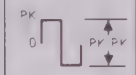
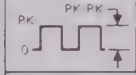
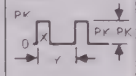
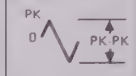


Figure 2-7. AC and DC Waveform Components

2-14. WAVEFORM COMPARISON AND CONVERSION

Figure 2-8 shows the relationship between common waveforms and the display readings for the 8062A and average-responding meters. Figure 2-8 also illustrates the relationship between ac and dc measurements for ac-coupled meters. For example, consider the first waveform, a 1.414V (0-pk) sinewave. Both the 8062A and the rms-calibrated average-responding meter display the correct rms reading of 1.000V (the dc component equals 0). However, consider the 1.414V (0-pk) rectified square wave. Both types of meters correctly measure the dc component (0.707V). But only the 8062A correctly measures the ac component (0.707V). The average-responding meter measures 0.785V, which amounts to a 5.6% error in the total rms measurement calculated from the ac and dc components.

AC COUPLED INPUT WAVEFORM	PEAK VOLTAGES		DISPLAY READINGS			DC AND AC TOTAL RMS
			AC COMPONENT ONLY		DC COMPONENT ONLY	TRUE RMS - $\sqrt{ac^2 + dc^2}$
	PK-PK	0-PK	RMS CAL*	8062A		
SINE 	2.828	1.414	1.000	1.000	0.000	1.000
RECTIFIED SINE (FULL WAVE) 	1.414	1.414	0.421	0.435	0.900	1.000
RECTIFIED SINE (HALF WAVE)	2.000	2.000	0.764	0.771	0.636	1.000
SQUARE 	2.000	1.000	1.110	1.000	0.000	1.000
RECTIFIED SQUARE 	1.414	1.414	0.785	0.707	0.707	1.000
RECTANGULAR PULSE  $D = \frac{X}{Y}$ $K = \sqrt{D - D^2}$	2.000	2.000	2.22K	2K	2D	$2\sqrt{D}$
TRIANGLE SAWTOOTH 	3.464	1.732	0.960	1.000	0.000	1.000

* RMS CAL IS THE DISPLAYED VALUE FOR AVERAGE RESPONDING METERS THAT ARE CALIBRATED TO DISPLAY RMS FOR SINE WAVES

Figure 2-8. Multiplication Factors for Converting Waveforms

Since average-responding meters have been in use for so long, you may have accumulated test or reference data based on them. The conversion factors in Figure 2-8 should help you convert between the two measurement methods.

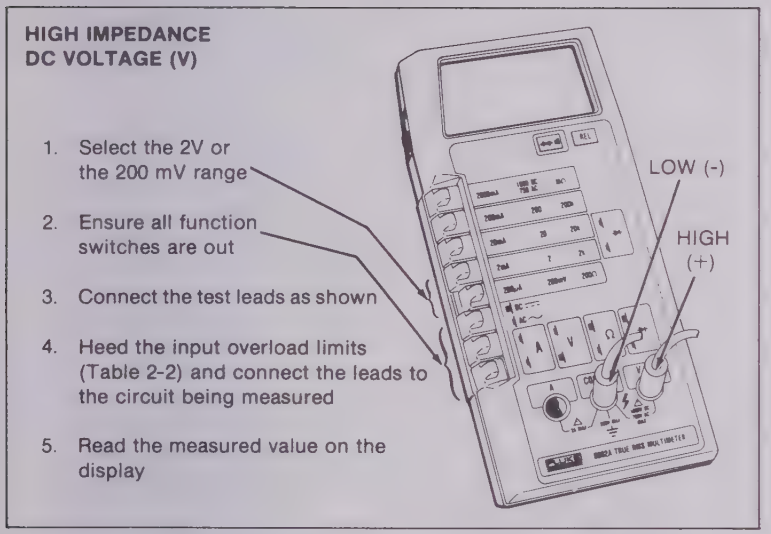

HIGH IMPEDANCE
DC VOLTAGE (V)
1. Select the 2V or the 200 mV range
2. Ensure all function switches are out
3. Connect the test leads as shown
4. Heed the input overload limits (Table 2-2) and connect the leads to the circuit being measured
5. Read the measured value on the display
LOW (-)
HIGH (+)

Figure 2-9. High Impedance DC Voltage

2-15. HIGH IMPEDANCE DC VOLTAGE

Occasionally you may want to make dc voltage measurements in high impedance circuitry where even the 10 MΩ input impedance for the normal dc voltage function could load the circuit and cause significant errors. For example, a 10 MΩ input impedance causes a .1% error when measuring the voltage across the 10 kΩ leg of a 90 kΩ over 10 kΩ voltage divider. The 8062A offers a >1000 MΩ (typically >10,000 MΩ) input impedance dc voltage function which greatly reduces this error.

Figure 2-9 describes how to select the high input impedance dc voltage function (the ac voltage function does not operate in this mode). Notice that all of the function switches must be out to select this function. Either the 2V or the 200 mV range may be selected.

NOTE

When taking measurements in the high impedance dc voltage function, do not select any ranges except the 2V or 200 mV ranges. Measurement in other ranges will result in erroneous readings.

NOTE

When the high impedance dc voltage function is selected and no inputis applied, noise from the environment (such as rf or power line noise) may cause the 8062A to display OL (overrange).

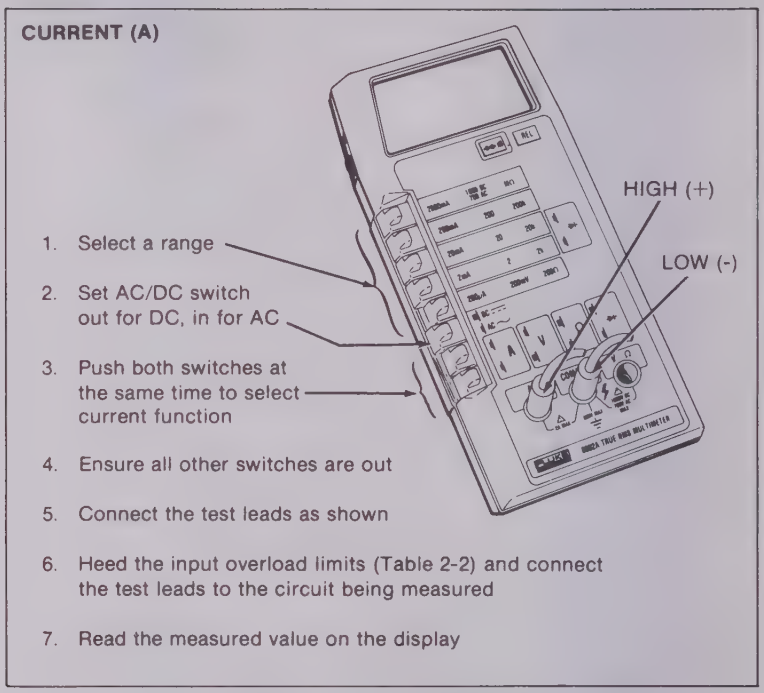

CURRENT (A)
HIGH (+)
LOW (-)
1. Select a range
2. Set AC/DC switch out for DC, in for AC
3. Push both switches at the same time to select current function
4. Ensure all other switches are out
5. Connect the test leads as shown
6. Heed the input overload limits (Table 2-2) and connect the test leads to the circuit being measured
7. Read the measured value on the display

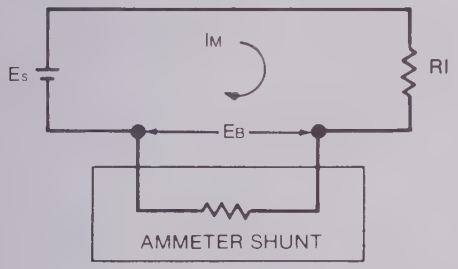
Figure 2-10. Current Operation

2-16. AC/DC Current (A)

Selection of the ac or dc current (A) function is described in Figure 2-10. The 8062A offers five ac (true rms ac-coupled) and five dc current ranges: 200 μA, 2 mA, 20 mA, 200 mA, 2000 mA. Each range is protected by a 2A/250V fuse in series with a 3A/600V fuse.

When a meter is placed in series with a circuit to measure current, you may have to consider an error caused by the voltage drop across the meter (in this case, across the protective fuses and current shunts). This voltage drop is called the burden voltage. The maximum full-scale burden voltages for the 8062A are 0.3V for the four lowest ranges and 0.9V for the highest range.

These voltage drops can affect the accuracy of a current measurement if the current source is unregulated and the resistance of the shunt and fuses represents a significant part (1/1000 or more) of the source resistance. If burden voltage does present a problem, you can calculate the error by using the formula in Figure 2-11. You can minimize this error by selecting the highest current range that provides the necessary resolution.



Es = Source voltage
RI = Load resistance + Source resistance
Im = Measured current (display reading in amps)
Eb = Burden voltage (calculated)
Eb = meas. current [(200/current range in mA) +.35]

ERROR:

Error in % = 100 x Eb/(Es - Eb)
Error in A = (Eb x Im)/(Es - Eb)

EXAMPLE:

Es = 15V
RI = 100 kΩ
Im = 148.51 μA (.14851 mA)

Eb = 148.51 x 10^{-6} x [(200/.2) + .35]

= 148.51 x 10^{-6} x 1000.35 = 148.56 mV

Max. error in % = 100 x [148.56 mV/(15V - .14856V)] = 1.0003%

Add this to the range spec. accuracy:

Max. error in % = 1.0003% ±(0.3% + 2 digits)

Max. error in A = (148.56 mV x 148.51 μA)/(15000 mV - 148.56 mV)

= 1.486 μA

Add 1.486 μA to the reading for correct current

Figure 2-11. Calculating Burden Voltage Error

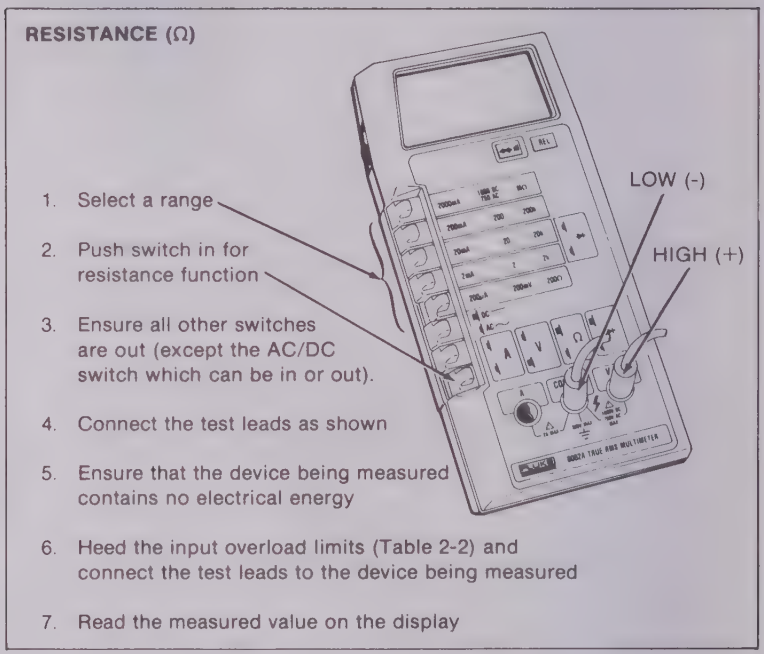

RESISTANCE (Ω)
1. Select a range
2. Push switch in for resistance function
3. Ensure all other switches are out (except the AC/DC switch which can be in or out).
4. Connect the test leads as shown
5. Ensure that the device being measured contains no electrical energy
6. Heed the input overload limits (Table 2-2) and connect the test leads to the device being measured
7. Read the measured value on the display
LOW (-)
HIGH (+)

Figure 2-12. Resistance Operation

2-17. Resistance (Ω)

Selection of the resistance function is described in Figure 2-12. There are four fixed ranges (200Ω, 2 kΩ, 20 kΩ, 200 kΩ) plus the autoranging MΩ range consisting of three ranges: 2 MΩ, 20 MΩ, and 300 MΩ.

In all fixed resistance ranges (200Ω to 200 kΩ), the test voltage is less than that required to turn on most semiconductor junctions. This feature, sometimes referred to as "low power" ohms, aids in troubleshooting by allowing you to measure resistors independent of the effects of in-circuit transistors and diodes. For the fixed ranges the maximum full scale voltage across the circuit being measured is less than 250 mV. The autoranging MΩ ranges have enough voltage to turn on semiconductor junctions (maximum 2.5V full scale), but the current is very low (2.2 μA maximum).

Resistance measurements for all ranges are made using a two-wire ratiometric technique. This means that test lead resistance may affect the accuracy in the 200Ω range. You can correct this error by shorting the test leads together, reading the test lead resistance, and then subtracting it from resistance readings. The most convenient way to do this is with the relative function as described later in this section. This technique is also useful for removing the .02Ω error factor in the 200Ω range (refer to resistance specifications in Section 1).

2-18. AUTORANGING MEGOHMS

When the autoranging MΩ range is selected, the 8062A automatically selects the range appropriate for the measurement. The measurement resolution decreases in the two higher MΩ ranges as shown in Table 2-3. Readings made at the crossover points between ranges are microcomputer-stabilized by an offset in the upscale and downscale directions. Range changes are made at 2.00 MΩ and 20.00 MΩ as readings go upscale, or at 19.0 MΩ and 1.90 MΩ as readings go downscale.

Table 2-3. Resistance Function Autoranges and Resolution

RANGE			RESOLUTION	NO. OF DIGITS POSSIBLE IN READING
MΩ Auto-Range	2 MΩ		100Ω	4½
	20 MΩ		10 kΩ	3½
	300 MΩ	20 to 99.9 MΩ	100 kΩ	3
		100 to 300 MΩ	1 MΩ	3
kΩ Auto-Range	2 kΩ		0.1Ω	4½
	20 kΩ		10Ω	3½
	300 kΩ	20 to 99.9 kΩ	100Ω	3
		100 to 299 kΩ	1 kΩ	3

2-19. AUTORANGING KILOHMS

Although it is not indicated on the front panel, there is an additional autoranging range available: the autoranging kΩ range, which consists of 2 kΩ, 20 kΩ, and 300 kΩ ranges. To select this range, you must simultaneously press the MΩ and the 200Ω switches as shown in Figure 2-13. Like the autoranging MΩ ranges, the autoranging kΩ ranges have enough voltage to turn on semiconductor junctions. Note that the use of the relative function with the autoranging kΩ ranges is restricted to the autoranging kΩ ranges. Refer to the description of the relative function for more information. The autoranging kΩ has the same decrease in resolution (see Table 2-3) and the same display hysteresis as the autoranging MΩ.

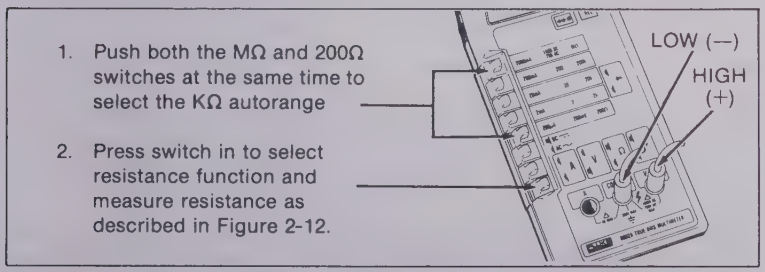

1. Push both the MΩ and 200Ω switches at the same time to select the KΩ autorange
2. Press switch in to select resistance function and measure resistance as described in Figure 2-12.
LOW (—)
HIGH (+)

Figure 2-13. Selection of Autoranging Kilohms

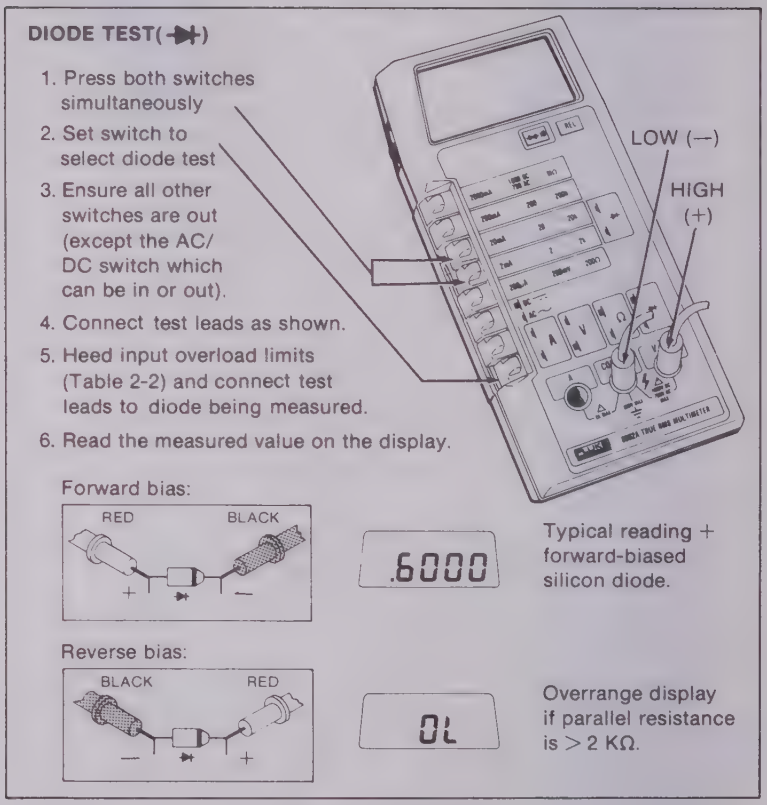

DIODE TEST(⊣▶⊢)
1. Press both switches simultaneously
2. Set switch to select diode test
3. Ensure all other switches are out (except the AC/DC switch which can be in or out).
4. Connect test leads as shown.
5. Heed input overload limits (Table 2-2) and connect test leads to diode being measured.
6. Read the measured value on the display.
LOW (—)
HIGH (+)
Forward bias:
RED
BLACK
+
—
.6000
Typical reading + forward-biased silicon diode.
Reverse bias:
BLACK
RED
—
+
OL
Overrange display if parallel resistance is > 2 KΩ.

Figure 2-14. Diode Test

2-20. Diode Test (⊣▶⊢)

Selection of the diode test is described in Figure 2-14. Notice how the test leads are placed to forward-bias or reverse-bias the diode in the figure.

The diode test measures the forward voltage of a semiconductor junction (or junctions) at a 1 mA (±10%) test current. Readings are displayed in the 2V range, with OL displayed for voltages greater than 2V. For a silicon diode, the typical forward voltage at 1 mA is about 0.6V. A reverse-biased semiconductor junction should display the overrange (OL) indicator provided that any resistance parallel to the junction is greater than 2 kΩ.

A quick way to check for shorted or open junctions is to reverse the test leads. If the junction indicates the same in-scale reading both directions, it is probably shorted. If the junction indicates an overrange both directions, it is open.

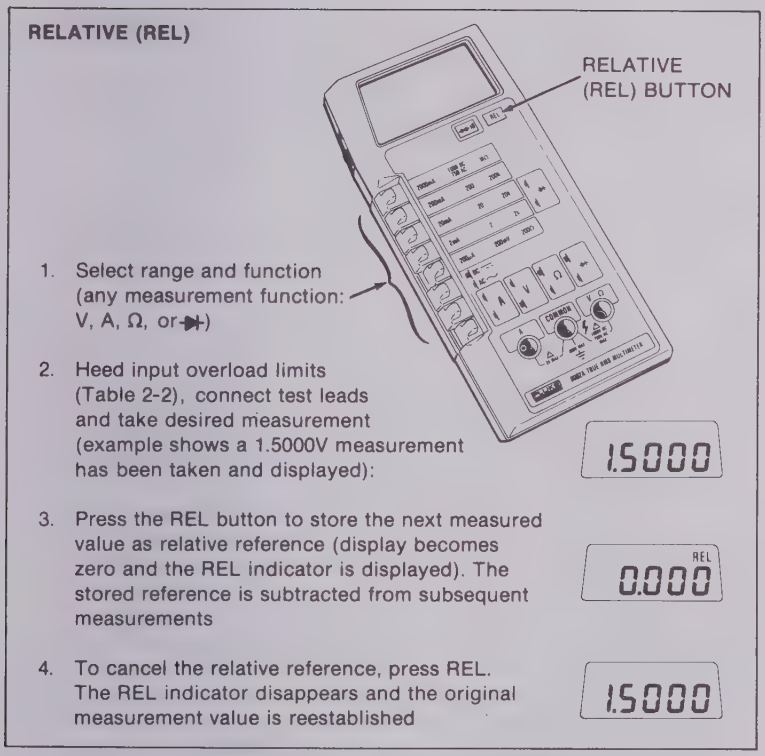

RELATIVE (REL)
RELATIVE
(REL) BUTTON
1. Select range and function (any measurement function: V, A, Ω, or →|)
2. Heed input overload limits (Table 2-2), connect test leads and take desired measurement (example shows a 1.5000V measurement has been taken and displayed):
1.5000
3. Press the REL button to store the next measured value as relative reference (display becomes zero and the REL indicator is displayed). The stored reference is subtracted from subsequent measurements
REL
0.000
4. To cancel the relative reference, press REL. The REL indicator disappears and the original measurement value is reestablished
1.5000

Figure 2-15. Relative (REL) Operation

2-21. Relative (REL)

The relative function allows you to store any reading as an offset or relative reference value. When you press the REL button, the REL indicator appears in the upper right corner of the display, and the 8062A stores the next measurement in a register along with the function and range. Subsequent measurements are displayed as the difference between the measured value and the stored relative reference (refer to Figure 2-15).

For example, if a reading of 1.0000V dc is displayed when the REL button is pressed (the display will read 0.0000 after REL is pressed), subsequent readings will have 1.0000 subtracted from them. If the next measurement is 1.2700V dc, the reading displayed will be .2700. If the next measurement is 0.8500V dc, the reading displayed will be -.1500. You may cancel the relative reference by pressing the REL button (the REL indicator disappears from the display), by turning the instrument off, or by storing a relative reference with another function.

If you change ranges, the relative reference is automatically multiplied or divided by the appropriate power of ten before being subtracted from the measurement. If you change functions, the REL indicator disappears and the relative reference is stored with the original function. When you reselect the function, the relative reference is restored (the REL indicator reappears) unless a new relative reference was established in another function.

The relative function may be used with all the measurement functions: ac or dc voltage, ac or dc current, resistance, and diode test. When used with continuity, the relative function stores the accompanying resistance readings. Note that the input overload limits are not affected by the use of the relative function.

Another thing to be aware of when using relative reference is that the range of possible readings is still subject to the limits of the display and the 19999 counts of the analog-to-digital (a/d) converter, regardless of the relative reference. For example, suppose the instrument is in the dc voltage function with the 20V range selected, and you store a relative reference of 15V. The maximum positive voltage reading that can be displayed without overranging is 4.999V, which is actually a 19.999V input signal. Any input signal greater than 4.999V exceeds the 19999 counts of the a/d converter. The minimum (negative) voltage reading that may be displayed without overranging is –19.999V, which is a –4.999V input signal. Any input signal less than –4.999V causes an overrange (indicated by OL on the display) because the display has reached negative full-scale. You can avoid this situation by selecting a higher range.

Remember that even though the REL indicator appears on the display almost instantaneously after the REL button is pressed, the relative reference is not stored until the next measurement takes place. For all functions, the time between measurements is about 0.4 seconds.

A typical way to use the relative reference is to correct for test lead resistance. Although test lead resistance is usually very small (typically two or three Ω), it can be significant when measuring low resistances. To correct for it, select the desired resistance range, short the test leads together, and press the REL button. The REL indicator will appear and the display will read zero. The 8062A will automatically subtract the stored test lead resistance from subsequent measurements. Other common applications for relative reference include: offset nulling (dc and ac voltage or current), diode and transistor matching (diode test), resistor matching (Ω) and voltage deviation (ac and dc voltage).

NOTE

The use of the relative function with the autoranging kΩ ranges is restricted to the autoranging kΩ ranges. If you take a reference reading within the autoranging kΩ range and then use it as a reference outside autoranging kΩ, or use a reference reading taken outside autoranging kΩ within autoranging kΩ, errors will result. There is no restriction on the use of the relative function with the fixed resistance ranges or with autoranging MΩ.

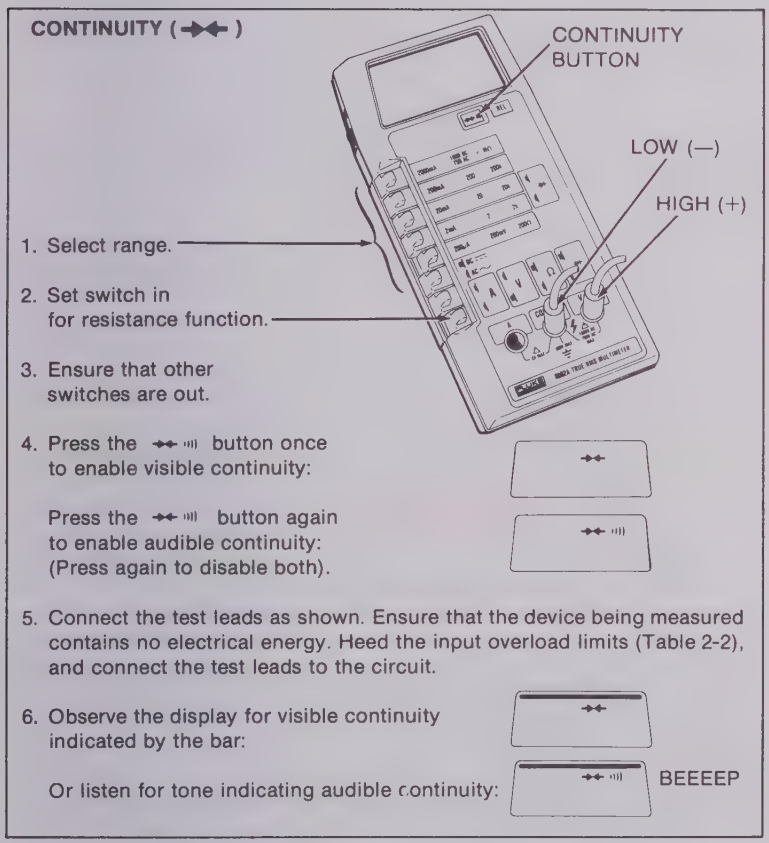

CONTINUITY (→←)
CONTINUITY BUTTON
LOW (—)
HIGH (+)
1. Select range.
2. Set switch in for resistance function.
3. Ensure that other switches are out.
4. Press the →←))) button once to enable visible continuity:
Press the →←))) button again to enable audible continuity: (Press again to disable both).
5. Connect the test leads as shown. Ensure that the device being measured contains no electrical energy. Heed the input overload limits (Table 2-2), and connect the test leads to the circuit.
6. Observe the display for visible continuity indicated by the bar:
Or listen for tone indicating audible continuity:
BEEEEP

Figure 2-16. Continuity (→←) Operation

2-22. Continuity (→←))

To select the continuity function, first select the resistance function and then press the →←))) button under the display. The →←))) button functions like a three-position switch: the first button press enables visible continuity (the →← indicator is displayed), the second button press enables audible continuity (the →←))) indicator is displayed), and the third button press cancels continuity selection (the →←))) indicator disappears). The selection of continuity is summarized in Figure 2-16. When continuity is detected, visible continuity is indicated by the long bar across the top of the display. Audible continuity (if enabled) is indicated by the tone emitted from the instrument.

Continuity is a quick check to verify whether circuit connections are intact. The continuity detection threshold is typically <50% of the resistance range selected

for the fixed ranges (i.e. continuity is detected if resistance is less than 100Ω in the 200Ω range, less than 1 kΩ in the 2 kΩ range, etc.). The detection threshold is <100Ω for the autoranging kΩ range, and <100 MΩ for the autoranging MΩ range.

The 8062A can detect continuity for intervals as brief as 50 μs (typcially as brief as 10 μs). It extends the visible or audible indication to a minimum of 200 ms to make it easy to observe results. Note that while continuity is enabled, the 8062 still makes resistance measurements and displays the readings.

2-23. INITIAL CHECK-OUT PROCEDURE

Here is an easy procedure you can use to verify that your 8062A is operating properly for most functions. All you need to perform these tests are the test leads and access to a standard wall socket. Remember that you are not trying to verify the instrument accuracy, but are simply confirming that the functions work. Performance tests and calibration adjustments are presented in Section 4. If the instrument passes the self-test when the instrument is first turned on, then the display and the microcomputer are working properly.

1. DC VOLTAGE - Select the dc voltage function and the 20V range. Read the battery voltage by touching the probe tip from the lead connected to the VΩ jack to the side contact (not the center pin) in the opening for the battery eliminator jack on the right side of the instrument. Be careful not to short the battery by connecting the side contact to the center pin. Battery voltage should read 5.2V to 10V. If the voltage is less than 5.2V, the battery should be replaced.

WARNING

LOCAL LINE VOLTAGE IS MEASURED IN THE FOLLOWING STEP. DO NOT TOUCH THE PROBE TIPS WITH YOUR FINGERS, OR ALLOW THE PROBE TIPS TO CONTACT EACH OTHER.

2. AC VOLTAGE, - Select the ac voltage function and the 200V range. Take note of the preceding warning and insert the probe tips into a standard wall socket. The display should read the local line voltage. Carefully remove the probe tips from the wall socket.

3. RESISTANCE, CONTINUITY, DIODE TEST - Select the resistance function and the 2 kΩ range. Touch the red (VΩ) probe tip to the A jack so the VΩ input is shorted to the A input (this is the fuse check procedure from Section 2-4). The display should read .1000 ±.0100 kΩ (neglecting lead resistance).

Push the ⊷))) button twice to enable the visible and audible continuity. You should see the bar in the display and hear the tone.

Select the diode test (with the VΩ and A inputs still shorted together). The display should read .0102 ±.0015V.

Remove the connection between the inputs. The instrument should indicate 0L.

Section 3
Theory of Operation

3-1. INTRODUCTION

This section describes how the 8062A works. An overview of the operation is provided first, followed by descriptions of the two major components and the measurement functions. A detailed schematic of the instrument appears in Section 7.

3-2. FUNCTIONAL DESCRIPTION

The major circuits and components of the 8062A are arranged in a block diagram in Figure 3-1. Two major components make up the measurement system: a four-bit CMOS microcomputer, and a CMOS integrated circuit known as the Measurement Acquisition Chip (MAC). The microcomputer selects the appropriate measurement function in the MAC according to the switches or buttons pushed by the operator. The microcomputer also controls the measurement cycles, performs calculations on measured data, and drives the display. The MAC measures the conditioned input signals with the a/d converter or the frequency counter. The MAC also controls the power supply and the continuity tone generator. The microcomputer and the MAC communicate through a four-bit bidirectional bus and four control lines. Both components are described in more detail later in this section.

As shown in Figure 3-1, the input signals are routed by the range and function switches through the appropriate signal conditioners for input filtering and scale changes. Input signals for all measurement functions except frequency are converted to a proportional dc analog voltage that is applied to the a/d converter. The dual-slope a/d converter converts the dc analog voltage to a digital number that is sent to the microcomputer. Each of the major measurement functions are described later in this section.

3-3. Microcomputer

The four-bit CMOS microcomputer senses switch positions by reading status registers in the MAC, and senses button pushes through input lines connected directly to the microcomputer. The microcomputer processes the information and then selects the appropriate digital and analog configuration in the MAC by writing to an array of MAC control registers.

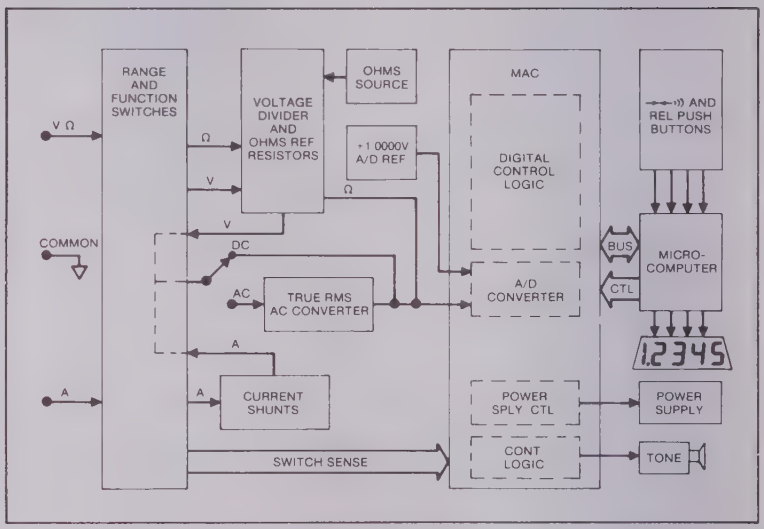


Figure 3-1. 8062A Block Diagram

The operation of the instrument is controlled by software routines that are stored in the microcomputer memory. These routines include the normal operating routine, the power-on self-test, or special self-test routines that may be selected by the operator. When the instrument is first turned on, the microcomputer performs the self-test routine which checks the LCD segments and the interface to the MAC (refer to Section 2 for operating instructions). While the LCD segments are on (a minimum of 1.6 seconnds), the microcomputer exercises the bus and checks the internal registers in the MAC to make sure it has control over them. If the microcomputer detectsa problem with the MAC interface, it stays in the self-test routine with the LCD segments on until the problem is resolved or the instrument is turned off.

After the power-on self-test routine is successfully completed, the microcomputer checks to see if the operator has selected the ratio self-test or the switch decoding self-test (refer to Section 4 for operating instructions). If neither of the self-tests has been selected, the microcomputer begins the normal operating routine. The operating routine consists of four steps:

1. The microcomputer reads the function and range selections and checks the two push buttons to determine the mode the operator has selected. The microcomputer then configures the a/d converter

2. The microcomputer initiates the a/d measurement cycle (approximately 400 ms) which is described later in this section.

3. The microcomputer processes the data obtained in the measurement cycle. This includes calculations for the relative (REL) offset and MΩ autoranging.

4. The microcomputer displays the results. The results remain on the display until it is updated.

After the results are displayed, the routine begins again at the first step.

3-4. Measurement Acquisition Chip (MAC)

A block diagram of the MAC is shown in Figure 3-1. The digital control logic includes a buffer and decoder, read and write logic, status and control registers, and logic control for the continuity function. The power supply control uses the calibrated 1.0000V a/d reference voltage obtained from a bandgap reference diode to regulate the 5.2V main power supply for the instrument. When the continuity function is selected and continuity is detected, the MAC generates the tone by supplying a square wave to the external piezoelectic transducer.

3-5. A/D Conversion Cycle

The heart of the MAC is the dual-slope a/d converter. A block diagram of the analog portion of the a/d converter is shown in Figure 3-2. The internal buffer, integrator, and comparators work in conjunction with external resistors and capacitors to convert the dc analog voltage to a digital number. The internal switches are FET switches that are controlled by the microcomputer and the MAC digital control logic. The switchable integrator gain depends on the function and range selected.

The complete a/d measurement cycle is shown in Figure 3-3. It consists of three consecutive time periods: autozero (AZ), integrate (INTEG) and read. A fourth time period, overload (OL) is also used if an overrange reading is taken. The total length of the measurement cycle is 400 ms. The length of the integrate period is fixed at 100 ms. One hundred ms is a multiple of the period of 50 Hz or 60 Hz power, which helps to reduce possible power line noise that might interfere with the measurement. The waveform at theINTEG capacitor is shown for three sample measurement readings: half-scale, full-scale, and overrange.

The measurement cycle begins with the autozero period. The AZ switches close, applying a ground reference as the input to the converter. Under ideal conditions the output of the comparator would also go to zero. However, input-offset voltage errors accumulate in the buffer amplifier loop, and appear at the comparator output as an error voltage. To compensate for this error, the error is impressed across the AZ capacitor where it is stored for the remainder of the measurement cycle. The stored level is used to provide offset voltage correction during the integrate and read periods.

The integrate period begins at the end of the autozero period. As the period begins, the AZ switches open and the INTEG switches close. This applies the unknown input voltage to the input of the converter. The voltage is buffered and then begins charging the INTEG capacitor. The waveform at the INTEG capacitor is a ramp from near zero to some maximum value determined by the amplitude and polarity of the unknown input voltage.

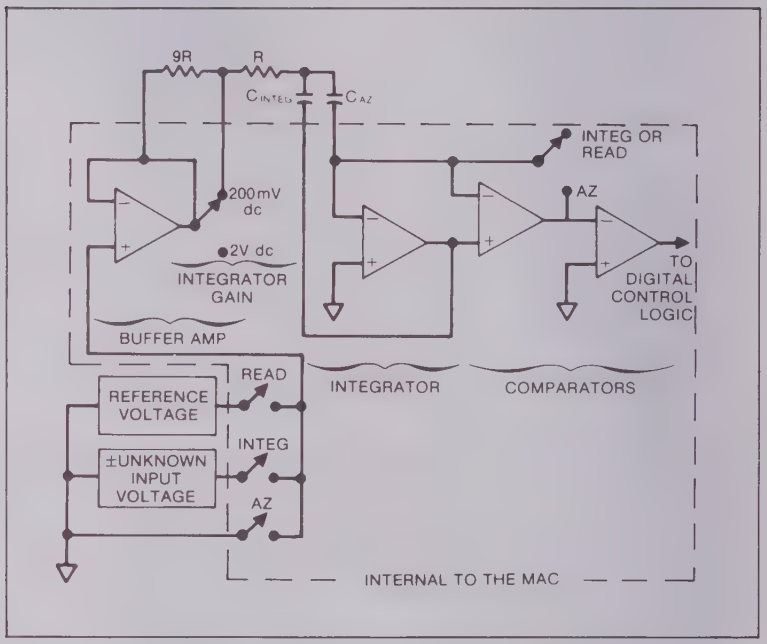


Figure 3-2. Analog Portion of the A/D Converter

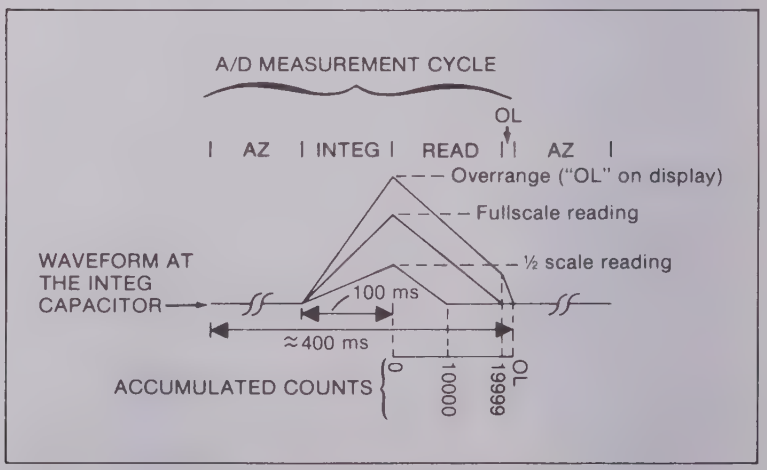


Figure 3-3. A/D Measurement Cycle

As the read period begins, the INTEG switches open and the READ switches close. This applies the known reference voltage from a "flying" capacitor whose polarity is chosen by the a/d converter to be the opposite of the polarity of the unknown input voltage. The INTEG capacitor begins discharging at a fixed rate while a counter begins counting. The counter stops counting when the INTEG capacitor voltage equals the initial autozero voltage. The count is proportional to the unknown input voltage, and is placed on the display by the microcomputer.

If during the read period the counter counts up to the maximum number of counts for a full-scale reading (19999 counts) and the INTEG capacitor charge has not yet reached the initial autozero voltage, the microcomputer knows an overrange reading has been taken. The microcomputer places "OL" on the display and commands the a/d converter to go into the overload (OL) period which rapidly slews the integrator voltage back to the initial autozero voltage.

The measurement cycle ends at the end of the read period for an on-scale reading, or at the end of the overload period for an overrange reading. A new measurement cycle then begins with the autozero period. The display update rate for measurement functions that use the a/d converter is approximately 0.4s, or about 2-1/2 readings per second.

3-6. Voltage Measurement

Both the ac and dc voltage ranges use an over-voltage-protected 10 MΩ input divider as shown in Figure 3-4. The over-voltage protection includes two 2-watt fusible resistors and four metal-oxide varistors for high voltage clamping.

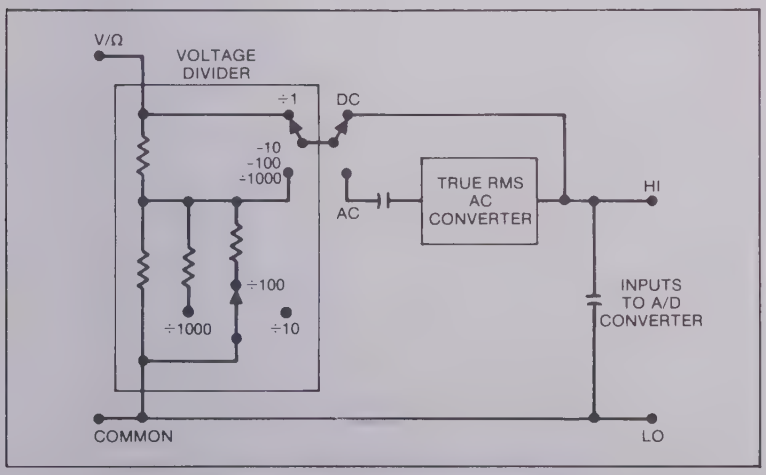


Figure 3-4. Voltage Measurement

Depending on the range selected, lower leg resistors of the divider are connected to ground to perform the input signal division.

The dc input voltages for all ranges are divided by the appropriate factor of 10 to produce a proportional dc signal which is then filtered and applied to the input to the a/d converter. The dc and ac voltage ranges anddivision factors are listed in Table 3-1 along with the corresponding range of inputs to the a/d converter. Notice in Table 3-1 that the 2V dc voltage range is divided by 1 (not 10). The microcomputer compensates by decreasing the integrator gain in the a/d converter by a factor of 10 (refer to Figure 3-2). The integrator gain is also reduced by a factor of 10 in the 1000V dc voltage range, which uses the same divider arrangement as the 200V dc voltage range.

The ac input voltages are divided with the same divider arrangement as the dc input voltages, with the exception that the 2V ac voltage range is divided by 10. The divider output signals for ac voltages are ac-coupled to the input of a true rms ac converter which produces a current output. A negative dc representation of the ac input signal is filtered and applied to the input of the a/d converter.

3-7. Current Measurement

Current measurements are made using a double-fuse-protected, switchable, five-terminal current shunt (0.1 ohm, 1 ohm, 10 ohm, 100 ohm or 1 kilohm) to perform the current-to-voltage conversion required by the a/d converter. A block diagram of current measurements is shown in Figure 3-5. When the dc current function is selected, the dc voltage drop across the shunt is filtered and applied to the input of the a/d converter. When the ac current function is selected the ac voltage drop across the shunt is ac-coupled to the input of the true rms ac converter. The dc representation of the ac voltage is filtered and applied to the input of the a/d converter. All current ranges use the ±200 mV a/d converter input range.

Table 3-1. Voltage Input Divider

FUNCTION	RANGE	INPUT DIVIDER	RANGE OF A/D CONVERTER INPUT
DC VOLTAGE	200 mV	1/1	-200 mV to +200 mV
	2V*	1/1	-2V to +2V
	20V	1/100	-200 mV to +200 mV
	200V	1/1000	-200 mV to +200 mV
	1000V*	1/1000	-2V to +2V (1V max. input)
AC VOLTAGE	200 mV	1/1	0 to -200 mV
	2V	1/10	0 to -200 mV
	20V	1/100	0 to -200 mV
	200V	1/1000	0 to -200 mV
	750V*	1/1000	0 to -2V (-0.75V max. input)
*Integrator gain in a/d converter reduced by factor of 10.			

3-8. Resistance Measurement

Resistance measurements are made using a ratio technique as shown in Figure 3-6. When the resistance function is selected, a series circuit is formed by the ohms source, a reference resistor from the voltage divider (selected by the range switches), and the external unknown resistor. The ratio of the two resistors is equal to the ratio of the voltage drop across each of them. Since the voltage drop across the reference resistor and the value of the reference resistor are known, the value of the second resistor can be determined. Input protection during resistance measurements consists of a thermistor and a double-transistor clamp.

The operation of the a/d converter during a resistance measurement is basically as described earlier in this section, with a few exceptions. During the integrate period the voltage drop across the unknown resistor charges the INTEG capacitor. During the read period, the voltage across the known resistor (stored on the flying capacitor) discharges the INTEG capacitor. The length of the read period is a direct indication of the value of the unknown resistor.

3-9. Continuity Measurement

Continuity measurement is a voltage comparison made in the resistance mode as illustrated in Figure 3-6. The 8062A determines whether continuity exists in the circuit under test by comparing the voltage drop across the external circuit with

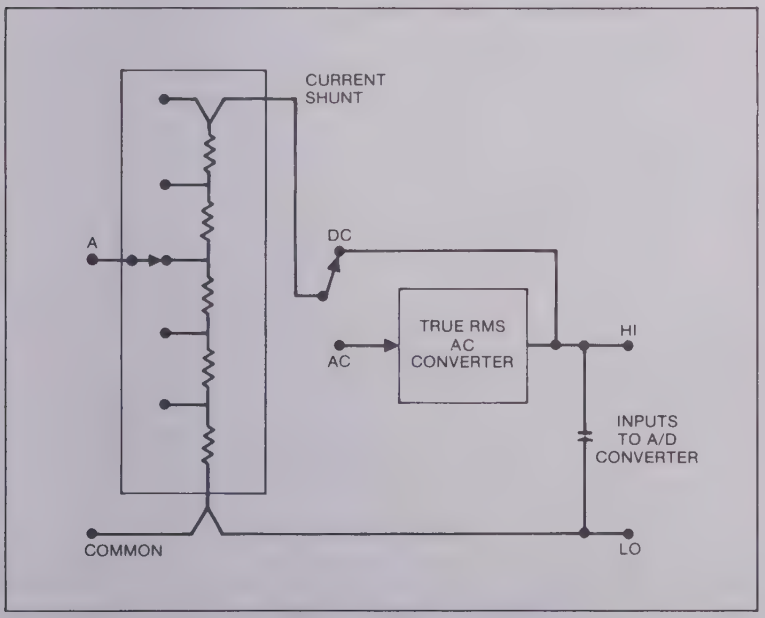


Figure 3-5. Current Measurement

a continuity reference voltage. If the voltage drop across the external circuit is less than the referencevoltage, the comparator sends the appropriate signal to the continuity logic. The continuity logic notifies the microcomputer which turns on the visible indicator (the full-length bar across the top of the display). If the audible indicator is enabled, the continuity logic enables the tone generator.

The detection threshold is typically 50% of the full scale resistance range selected. When the 8062A detects continuity for brief intervals (50 μs or greater), the microcomputer extends the visible and audible indication to a minimum of 200 ms to allow easy perception by the operator.

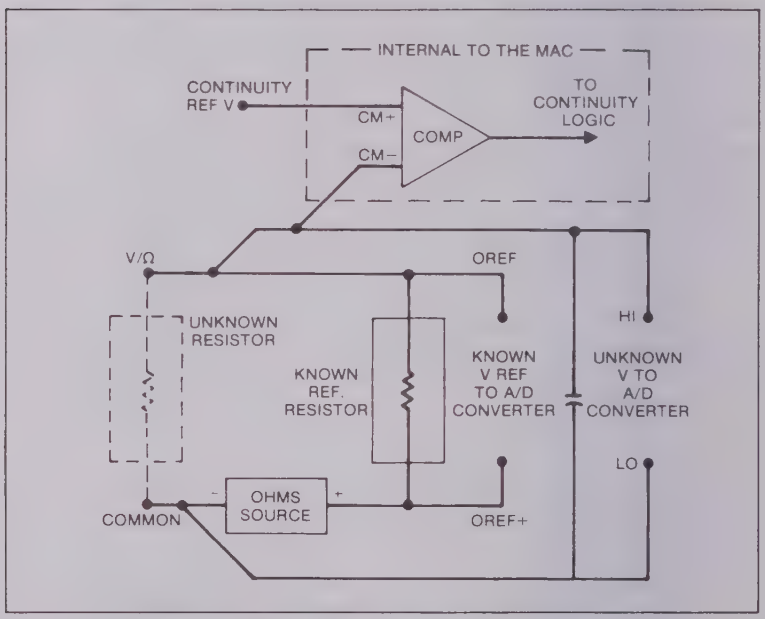


Figure 3-6. Resistance/Continuity Measurement

Section 4
Maintenance

WARNING

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

4-1. INTRODUCTION

This section of the manual contains information regarding the maintenance of your instrument. It includes information about disassembly, performance tests, calibration adjustments, and troubleshooting. The combined performance tests are recommended as an acceptance test when the instrument is first received, and can be used later as a preventive maintenance tool.

A one-year calibration cycle is recommended to maintain the specifications given in Section 1 of this manual. The test equipment required for the performance tests or calibration adjustments is listed in Table 4-1. Test equipment with equivalent specifications may also be used.

4-2. SERVICE INFORMATION

The 8062A is warranted for a period of one year upon shipment of the instrument to the original purchaser. Conditions of the warranty are given at the front of this manual. Malfunctions that occur within the limits of the warranty will be corrected at no cost to the purchaser. For in-warranty repair, call (toll-free) 800 426-0361 for the address of the nearest Fluke Technical Service Center designated to service your instrument (in Alaska, Hawaii, Washington, or Canada call 206-356-5400). Ship the instrument postpaid in the original shipping container (if available). Dated proof-of-purchase may be required for in-warranty repairs.

Fluke Technical Service Centers are also available for calibration and/or repair of instruments that are beyond the warranty period. Call (toll-free) 800 426-0361 for shipping information. Ship the instrument and remittance in accordance with instructions received.

Table 4-1. Required Test Equipment

EQUIPMENT	REQUIRED SPECIFICATIONS	RECOMMENDED TYPE
DMM Calibrator	DC Voltage: 0 to 1000V, ±(0.0075%) AC Voltage: 200 Hz to 1 kHz, 0 to 750V, ±(0.06%) 1 kHz to 10 kHz, 0 to 200V, ±(0.06%) 10 kHz to 30 kHz, 0 to 200V, ±(0.1%) 30 kHz to 50 kHz, 0 to 200V, ±(0.25%) 50 kHz to 100 kHz, 0 to 2.0V, ±(0.75%) Resistance: 100Ω to 10.0 MΩ, ±(0.01%)	John Fluke 5100B with Options Y5000, 5100A-03, and John Fluke 5205A Amplifier
	DC Current: 0 to 2000 mA, ±(0.05%) AC Current: 20 Hz to 3 kHz, 0 to 2000 mA, ±(0.25%)	John Fluke 5100B with Option Y5000 and John Fluke 5220A Amplifier
Reference Resistors	40 MΩ and 290 MΩ, ±(0.1%)	Caddock MG750*
Signal Source	Frequency: 25 mV to 200 mV, 100 Hz to 200 kHz, ±(0.01%)	John Fluke 6010A
DMM	DC Voltage: 200 mV to 20V, ±(0.25%) DC Current: 2 mA to 200 mA, ±(0.25%)	John Fluke 8020A
*Precision high MΩ resistors may be ordered from Caddock Electronics, 3127 Chicago Ave., Riverside, CA, 92507. Be sure to specify 0.1% tolerance.		

4-3. GENERAL INFORMATION

4-4. Handling Precautions for Using Static Sensitive Devices

CAUTION

This instrument contains CMOS components which can be damaged by static discharge. Static sensitive components on the main pcb include U3 and U4. The microcomputer pcb includes one static sensitive component, U5, the microcomputer. To prevent damage, take the following precautions when troubleshooting and/or repairing the instrument:

- Perform all work at a static-free work station.
- Do not handle components or pcb assemblies by their connectors.

- Wear static ground straps.
- Use conductive foam to store components.
- Remove all plastic, vinyl and styrofoam from the work area.
- Use a grounded, temperature-regulated soldering iron.

4-5. Disassembly and Reassembly

The instrument has two pcbs: the main pcb and the microcomputer pcb. To gain access to the calibration adjustments, the backup fuse, or the LCD, you have to remove only the top cover. You can also do some troubleshooting with only the top cover and the top ac shield off. For other troubleshooting or to gain access to the microcomputer pcb, you have to remove the main pcb from the case. If you remove the main pcb from the case, you will need to perform the calibration adjustments. Be sure to heed the notes and cautions about special handling requirements.

NOTE

It is not necessary to remove the main pcb from the botton case in order to disassemble or reassemble the LCD. However, because the LCD and the microcomputer require similar special handling, the disassembly and reassembly procedures are described together.

CAUTION

To avoid contaminating the pcbs with oil from the fingers, handle the pcbs by the edges or wear gloves. If a pcb does become contaminated, refer to the cleaning information given later in this section.

4-6. CALIBRATION AND BACKUP FUSE ACCESS

Use the following procedure to gain access to the calibration adjustments or the backup fuse (F2):

1. Disconnect the test leads and battery eliminator, if attached. Turn the power switch off.

2. Remove the three phillips screws from the bottom of the case.

3. Turn the instrument face-up and grasp the top cover at both sides of the input connectors. Then pull the top cover from the unit. The backup fuse and the calibration adjustments are now accessible (Figure 4-1).

CAUTION

The function buttons below the display are part of a single elastomeric strip (Figure 4-1) that is held in place by the top cover. When the top cover is removed, the elastomeric strip will be loose

and may be removed. Do not touch or contaminate the carbon-impregnated switch contacts on the bottom of the strip or the switch contacts on the microcomputer pcb. If the contacts do become contaminated, clean them with isopropyl alcohol.

4. To reassemble, position the elastomeric strip on the microcomputer pcb so that the small rubber posts on the bottom of the strip are properly seated. Install the top cover and fasten the three screws on the bottom case.

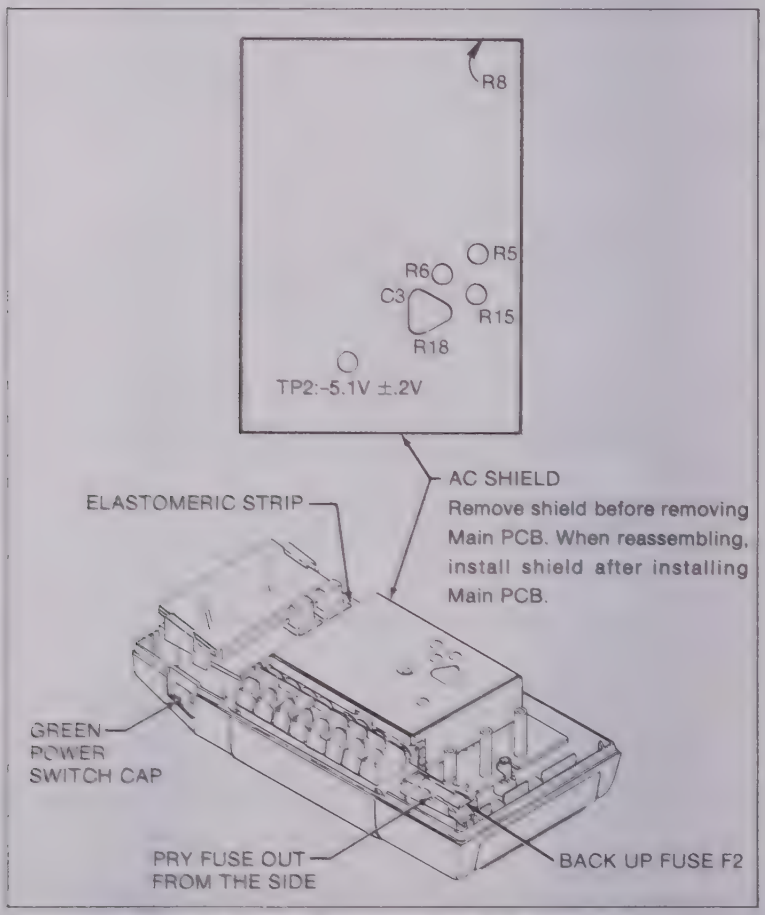


Figure 4-1. Calibration and Backup Fuse (F2) Access

4-7. MAIN PCB ACCESS

Use the following procedure to gain access to the main pcb:

1. Remove the screw in the center of the ac shield and remove the shield.

2. Using your index finger, lift up the lower right corner of the main pcb until it is free. Then pull the pcb to the right until it clears the shelf under the buttons.

CAUTION

Do not touch or contaminate the plastic insulator that is attached to the inside of the case bottom. When the instrument is assembled the insulator makes contact with the leads on the bottom of the main pcb. Contaminants could cause undesirable conduction paths. If the insulator becomes contaminated, clean with isopropyl alcohol.

3. Reassemble in the logical reverse order and heed the following notes:

   a. When reassembling, be sure to put on the ac shield after the main pcb has been placed in the case bottom. The reason for this is that the screw which holds down the ac shield has a spring attached. The spring provides the electrical connection between the top of the ac shield and the bottom of the shield (under the insulator). If the ac shield is attached to the main pcb before the main pcb is in the case, the spring may fold across the insulator and not be in proper position to make the electrical connection.

   b. Be sure to place the green power switch cap over the small black power switch before sliding the main pcb into the case.

   c. Be sure to route the battery-clip wires to the left side of the post under the backup fuse case.

4-8. LCD AND MICROCOMPUTER PCB DISASSEMBLY AND ASSEMBLY

NOTE

This procedure applies to models with s n 4025xxx and higher.

The procedure for disassembling or assembling the LCD and the microcomputer pcb is not difficult, but the steps must be followed in sequence. Before you try the procedure, examine the components in Figure 4-2 and familiarize yourself with the following handling precautions:

- The microcomputer, U5 (item 4 in Figure 4-2), is a static sensitive CMOS device. Follow standard procedures for handling static sensitive devices.

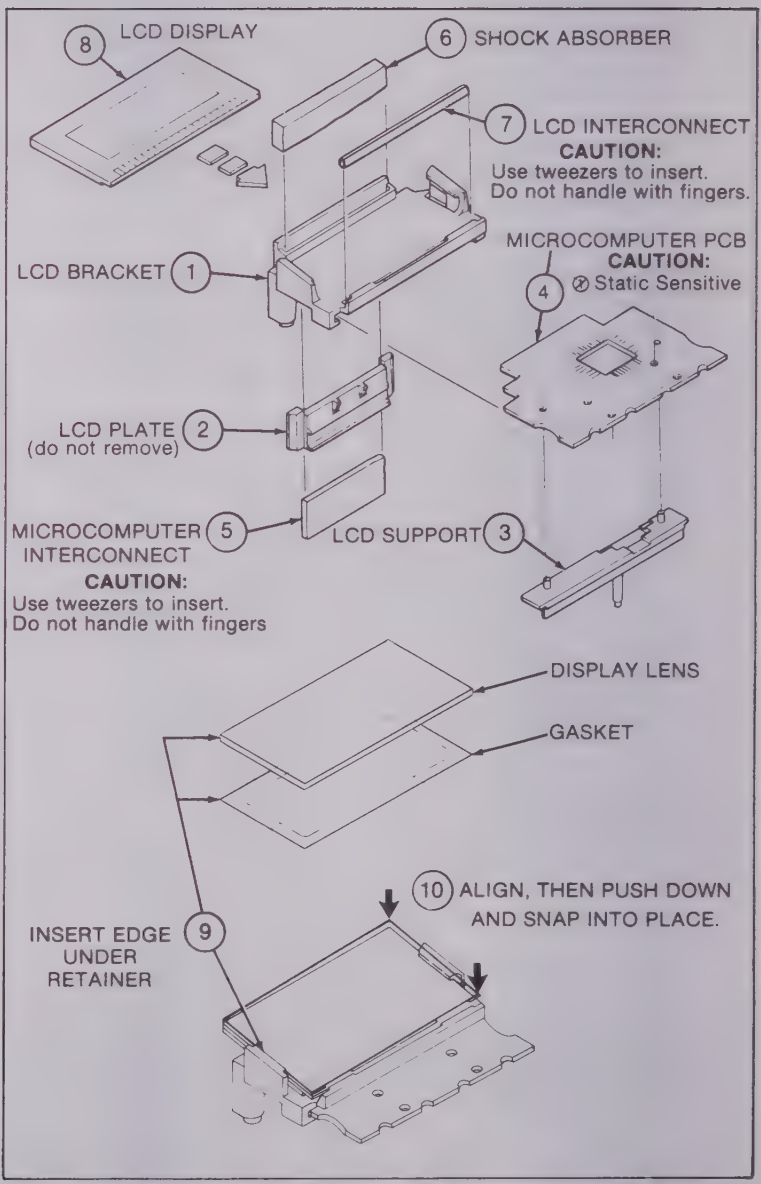


Figure 4-2. Assembling/Disassembling the Microcomputer PCB and LCD

- The LCD interconnect (item 7) and the microcomputer interconnect (item 5) should not be touched with fingers or contaminated. Handle these items with tweezers and keep them clean.

- The microcomputer interconnect (item 7) is susceptible to corrosion caused by the reaction between the metal in the connector and possible contaminates in the air such as smoke or sulfer. Store the connector in an air-tight container if the LCD is disassembled for a long period of time.

- Do not get fingerprints or dirt on the LCD display, the display lens, or the gasket.

- While the LCD and microcomputer pcb are assembled, take care not to press down on the display lens because pressure could damage the LCD.

To disassemble the LCD, use your thumbnails and push on the corners of the LCD display, gasket and display lens so that all three components slide out together as shown in Figure 4-3.

NOTE

It is not necessary to remove the main pcb from the bottom case to disassemble or reassemble the LCD.

To assemble the LCD, use the following procedure:

1. Align the LCD display (item 8) as indicated in Figure 4-2 and slide it into place. The bottom edge of the LCD display should compress the LCD interconnect (item 7) and slide underneath the two plastic notches on the LCD bracket (item 1).

2. Refer to Figure 4-2 and follow steps 9 and 10 to complete assembly.

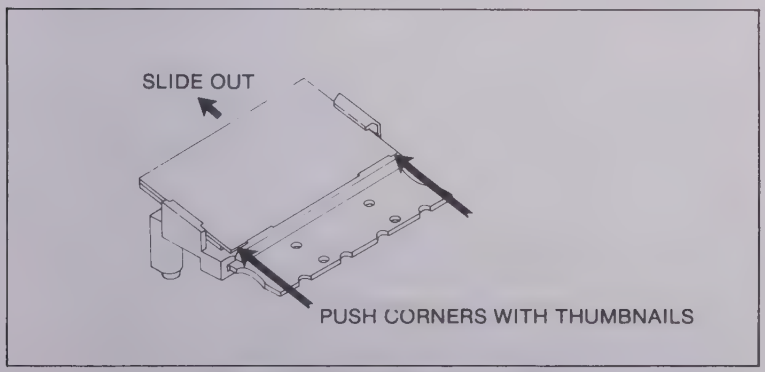


Figure 4-3. Disassembling the LCD

To disassemble the microcomputer pcb, use the following procedure:

1. Turn the main pcb face down and remove the two small screws at the top of the pcb to free the microcomputer pcb.

2. Refer to Figure 4-2. Beginning with item 7, remove items 7 through 3 (leave item 2 attached to item 1). Be sure to observe the handling precautions for items 7, 5, and 4.

To assemble the microcomputer LCD, refer to Figure 4-2. Beginning with item 3, assemble items 3 through 7 (in ascending numerical order). Be sure to follow the handling precautions for items 4, 5, and 7.

4-9. Backup Fuse Replacement

Use the following procedure to replace the backup fuse (F2):

1. Remove the top cover by following the precautions given previously for the calibration and backup fuse access.

2. Use a flat-tipped screwdriver to pry the fuse out of its fuse holder. Pry the fuse from the side as indicated in Figure 4-1.

3. Replace the defective backup fuse with a 3A/600V type BBS-3 (John Fluke 457004). Refer to Section 2-4 for information about replacing fuse F1 (2A/250V; American style: fast acting type AGX2, 1/4 x 1", John Fluke 376582; European style: 5 x 20 mm, John Fluke 460972).

4-10. Cleaning

CAUTION

Do not use aromatic hydrocarbons or chlorinated solvents for cleaning. These solutions will react with the plastic materials used in the instrument.

CAUTION

Do not allow the liquid crystal display to come in contact with moisture. Remove the LCD and microcomputer pcb before washing the main pcb and do not install it until the pcb has been fully dried.

Clean the front panel and case with a mild solution of detergent and water. Clean dust from the main pcb with low pressure (<20 psi) dry air. Clean contaminates from the main pcb with isopropyl alcohol and a soft brush, followed by demineralized water and a soft brush (remove the LCD and microcomputer pcb before washing, and avoid getting excessive amounts of water on the switches). Dry with clean, dry air at low pressure, and then bake at 50 to 60°C (124 to 140°F) for 24 hours.

4-11. PERFORMANCE TESTS

The following procedures allow you to compare the performance of your instrument with the specifications listed in Section 1. They are recommended for incoming inspection, periodic calibration, and to verify specifications. If the instrument fails any test, calibration adjustment and/or repair is needed. You do not have to disassemble the instrument to perform the tests. Throughout these procedures, the 8062A being tested is referred to as the UUT (Unit Under Test).

4-12. Initial Procedure

For any of these tests, make sure you do the following:

1. Allow the temperature of the UUT to stabilize in a test environment with an ambient temperature of 23 ±5°C (73 ±9°F) and a relative humidity of less than 80%.

2. Check the fuses and battery and replace them, if necessary.

3. Make sure the leads are disconnected from the UUT. Set the power switch to on and set all other switches to the out (off) position.

4-13. Microcomputer and Display Test

Use the automatic power-on self-test to test the microcomputer and the LCD display. Turn the UUT off, then turn it on while observing the display. All of the LCD segments should turn on. After about one or two seconds, the display should go blank briefly and then respond to switch selections.

4-14. Voltage Test

Use the following procedure to verify proper operation of the dc and ac voltage, functions.

1. Connect the UUT and the DMM Calibrator as shown in Figure 4-4.

2. For each step in Table 4-2, select the UUT function and range as indicated. Program the DMM Calibrator for the specified input signal and verify that the displayed UUT value is within the indicated limits.

4-15. Resistance Test

Use the following procedure to verify proper operation of the resistance function:

1. Connect the UUT and the DMM Calibrator as shown in Figure 4-4.

2. Select the resistance function and follow the steps 1 through 7 as listed in Table 4-3. For each step, select the UUT function and range as indicated. Program the DMM Calibrator for the specified input signal and verify that the displayed UUT value is within the indicated limits.

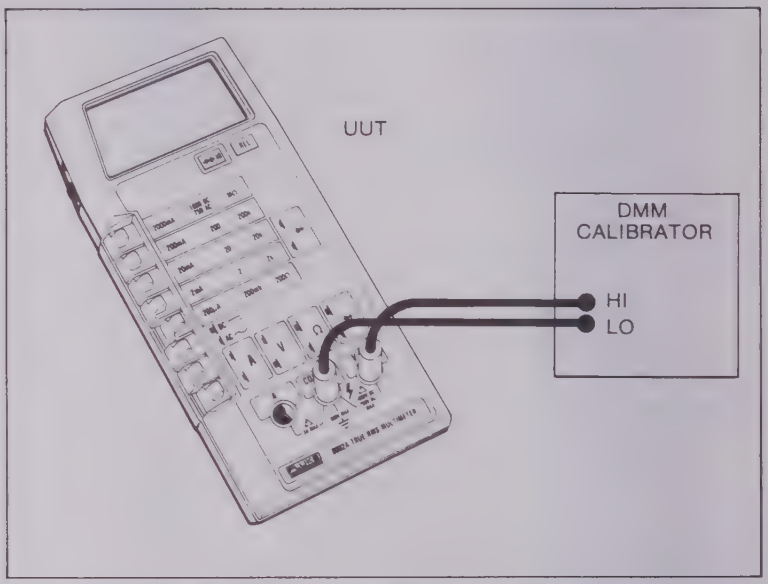


Figure 4-4. General Equipment Connection

NOTE

Most DMM Calibrators do not test resistance values beyond 10 MΩ. To test the resistance function beyond 10 MΩ (optional steps 8 and 9 in Table 4-3), disconnect the DMM Calibrator and connect a precision Reference Resistor for each value.

4-16. Continuity Test

Use the following procedure to verify proper operation of the continuity function:

1. Connect the UUT and the DMM Calibrator as shown in Figure 4-4.

2. Select the resistance function and the 2 kΩ range. Press the ⊷ button once. The ⊷ symbol should appear on the display.

3. Apply a resistance of 100.0Ω. The long bar across the top of the display should appear on the display immediately. A reading of .0997 to .1003 should appear shortly thereafter (negating any test lead resistance).

4. Press the ⊷ button to enable the audible continuity (the 100.0Ω still applied). The symbol should appear on the display with the ⊷ symbol. The tone should sound.

Table 4-2. Voltage Test

STEP	FUNCTION	RANGE	INPUT SIGNAL		DISPLAY LIMITS
			LEVEL	FREQ.	
1	DC Voltage	200 mV	+190.00 mV	dc	+189.89 to 190.11
2		200 mV	-190.00 mV		-189.89 to -190.11
3		2V	1.9000V		1.8989 to 1.9011
4		20V	19.000V		18.985 to 19.015
5		200V	190.00V		189.85 to 190.15
6		1000V	1000V		999.1 to 1000.9
7	AC Voltage	200 mV	100.00 mV rms	200 Hz	99.40 to 100.60
8				20 kHz	98.60 to 101.40
9	AC Voltage	2V	1.0000V rms	200 Hz	.9940 to 1.0060
10			1.0000V rms	1 kHz	.9930 to 1.0070
11			1.0000V rms	10 kHz	.9930 to 1.0070
12			1.0000V rms	30 kHz	.9860 to 1.0140
13			1.0000V rms	20 Hz	.9890 to 1.0110
14			100.0 mV rms	200 Hz	.0985 to .1015
15			100.0 mV rms	30 kHz	.0950 to .1050
16	AC Voltage	20V	10.000V rms	200 Hz	9.940 to 10.060
17			10.000V rms	10 kHz	9.480 to 10.520
18			10.000V rms	30 kHz	9.460 to 10.540
19	AC Voltage	200V	100.00V rms	200 Hz	99.40 to 100.60
20		200V	100.00V rms	10 kHz	94.80 to 105.20
21		200V	100.00V rms	30 kHz	94.60 to 105.40
22		750V	750.0V rms	100 Hz	734.0 to 766.0
23		750V	750.0V rms	1 kHz	734.0 to 766.0

Table 4-3. Resistance Test

STEP	RANGE	INPUT RESISTANCE	DISPLAY LIMITS
1	200Ω	short circuit	0.00 to 0.04
2	200Ω	100.00Ω	99.86 to 100.14
3	2 kΩ	1.0000 kΩ	.9988 to 1.0012
4	20 kΩ	10.000 kΩ	9.988 to 10.012
5	200 kΩ	100.00 kΩ	99.88 to 100.12
6	MΩ	1.0000 MΩ	.9978 to 1.0022
7	MΩ	10.00 MΩ	9.95 to 10.05
8 (optional)	MΩ	40.0 MΩ	39.3 to 40.7
9 (optional)	MΩ	290 MΩ	282 to 298

5. Remove the connections to the input of the UUT. The tone should stop and the bar should disappear from the display. The display should indicate OL (overrange) along with the ⊶ and ⫼ symbols.

4-17. Current Test

Use the following precautions to verify proper operation of the dc and ac current functions:

1. Connect the UUT and the DMM Calibrator as shown in Figure 4-5.

2. For each step in Table 4-4, select the UUT function and range as indicated. Program the DMM Calibrator for the specified input signal and verify that the displayed UUT value is within the indicated limits.

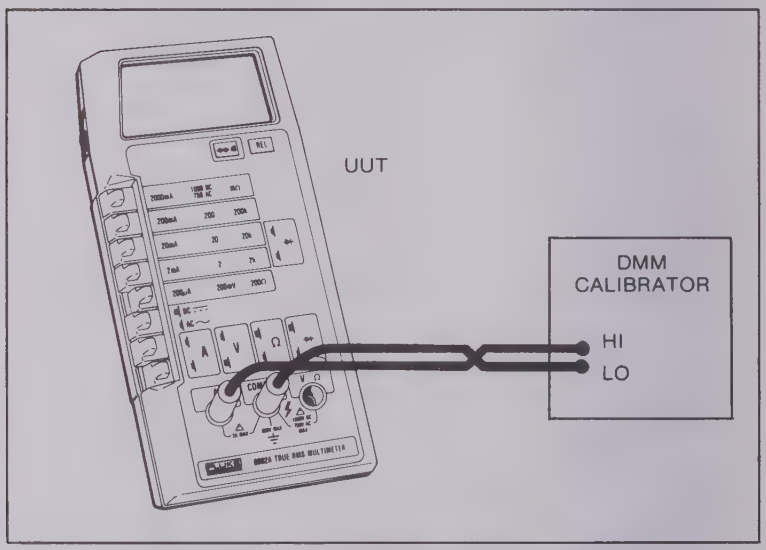


Figure 4-5. Equipment Connection for Current Test

Table 4-4. Current Test

STEP	FUNCTION	RANGE	INPUT SIGNAL		DISPLAY LIMITS
			LEVEL	FREQ.	
1	Current dc	200 μA	190.00 μA	dc	189.41 to 190.59
2		200 μA	-190.00 μA	dc	-189.41 to -190.59
3		2 mA	1.9000 mA	dc	1.8941 to 1.9059
4		20 mA	19.000 mA	dc	18.941 to 19.059
5		200 mA	190.00 mA	dc	188.65 to 191.35
6		2000 mA	1900.0 mA	dc	1886.5 to 1913.5
7		2000 mA	-1900.0 mA	dc	-1886.5 to -1913.5
8	Current ac	20 mA rms	19.000 mA	1 kHz	18.848 to 19.152

4-18. Diode Test

Use the following procedure to verify proper operation of the diode test:

1. Remove any connections to the inputs of the UUT and select the diode test function. The display should indicate OL (overrange).

2. Connect the UUT and the DMM Calibrator as shown in Figure 4-4 and apply a resistance of 1.000 kΩ. A reading of .9000 to 1.1000 (typical) should appear on the UUT display.

4-19. CALIBRATION ADJUSTMENTS

Under normal operating conditions the 8062A should maintain the specifications given in Section 1 of this manual for at least one year after calibration. If your 8062A has been repaired or if it has failed any of the performance tests, you need to perform the calibration adjustments.

Test equipment needed for the adjustments is listed in Table 4-1. If the test equipment is not available, your nearest John Fluke Service Center will be glad to help. Call (toll-free) 800 426-0361 for assistance. After you have completed the calibration adjustments, we recommend that you complete the performance tests to verify proper operation. In the following procedure, the 8062A that is being adjusted is referred to as the UUT (Unit Under Test).

NOTE

The top ac shield should remain installed on the instrument while the calibration adjustments are being performed. The positions of the trimpots and trimcaps are marked on the top ac shield along with a table summarizing the calibration procedures.

NOTE

The performance of the 8062A ac functions is affected by the capacitance between the main pcb and the bottom ac shield, which is dependent on the distance between them. The distance may vary, depending on whether the top cover is installed. To minimize performance variations, press down on the ac shield to simulate top cover installation while you perform the calibration adjustments. After you have performed the adjustments and installed the top cover, if you find that the measurement values obtained for the ac function performance tests are consistently too high or too low, remove the top cover and repeat the adjustments accordingly.

1. Allow the UUT to stabilize with the power off for at least 30 minutes at an ambient temperature of 21 to 25°C (70 to 77°F).

2. Complete the calibration access procedure presented earlier in this section.

3. Connect the equipment as shown in Figure 4-4 and turn on the equipment.

4. On the UUT, select the dc voltage function and the 2 volt range. Turn R6 fully clockwise (CW), and turn R5 fully counterclockwise (CCW).

5. Program the DMM Calibrator for an input of 1.9000V dc. Adjust R5 for a display reading slightly greater than 1.9000. Adjust R6 for a display reading between 1.8999 and 1.9001.

6. On the UUT, select the 200 mV range (dc voltage function).

7. Program the DMM Calibrator for an input of 190.00 mV dc. Adjust R8 for a display reading between 189.99 and 190.01.

8. On the UUT, select the ac voltage function and the 200 mV range. Turn R18 fully CW, and turn R15 fully CCW.

9. Program the DMM Calibrator for an input of 100.00 mV ac at 200 Hz. Adjust R15 for a display reading slightly greater than 100.00. Adjust R18 for a display reading between 99.95 and 100.05.

10. On the UUT, select the 200V range (ac voltage function). Program the DMM Calibrator for an input of 100.00V ac at 10 kHz. Adjust C3 until the display reading is between .9990 and 1.0010.

11. On the UUT, select the 2V range (ac voltage function). Program the DMM Calibrator for an input of 1.0000V ac at 10 kHz. Adjust C7 until the display reading is between 0.9990 and 1.0010.

12. Steps 10 and 11 interact. Repeat both steps until the appropriate limits are obtained for both steps.

4-20. TROUBLESHOOTING

CAUTION

Static discharge can damage MOS components U3, U4, and U5. Follow the handling precautions for static sensitive devices previously described in this section. Never remove, install or otherwise connect or disconnect components without first setting the instrument power switch off and disconnecting any inputs to the instrument.

If necessary, refer to Section 2 for operating instructions or Section 3 for the theory of operation. The troubleshooting information is supported by the schematics and tables in Section 7.

4-21. Self-Tests

The 8062A offers three self-tests: power-on self-test, ratio self-test, and switch decoding self-test. The power-on self-test is automatically performed whenever the instrument is turned on. It is described in Sections 2 and 3. The other two tests function as follows:

4-22. RATIO SELF-TEST

The ratio self-test is an operating mode of the 8062A in which the reference voltage for the a/d converter is applied to the a/d converter during both the integrate and the read periods. If the instrument is functioning properly, the display should read 10000 ± 10 counts (the decimal point location depends on the range, and does not affect the number of counts).

To select the ratio self-test, select a voltage or current function. Hold down the ⊷ button while you turn on the instrument. After the power-on self-test has been completed (the display is .8.8.8.8), release the ⊷ button. The instrument should now be in the ratio self-test mode. To cancel the ratio self-test, press the ⊷ button or turn off the instrument.

If the count is within tolerance, it gives a strong indication that the a/d converter is working properly. If the count deviates more than 5 counts from 10000, the probable causes are as follows (in order of probability): a/d converter in U3, leakage around or failure of C16, C18, Z3, R8, or the power supply.

4-23. SWITCH DECODING SELF-TEST

To select the switch decoding self-test, hold down the REL button while you turn on the instrument. After the power-on self-test has been completed (the display is .8.8.8.8), release the REL button. The instrument should now indicate the switch decoding. To cancel the switch decoding self-test, turn off the instrument.

The switch decoding self-test indicates how the software in the microcomputer interprets the configuration of the eight switches and four push buttons. Each function or range that may be selected corresponds to a number that appears in one of the digit positions on the display (see Table 4-5). Notice that if no range is selected, the microcomputer assumes the 200 (μA, mV, Ω) range is selected.

In some cases it may be helpful to know that the microcomputer scans the switches in order from SW5 to SW8 (there is no input for switch SW4, the default range). The microcomputer assumes the first range switch detected as being pushed in is the desired range. For example, if you press in both the 200V and 1000V switches while in dc voltage, the microcomputer assumes you want the 200V range. There is one exception: if the microcomputer detects that the 2 kΩ switch is selected, it checks for the 20 kΩ switch which indicates diode test selection when pushed in.

Also during the switch decoding self-test, the continuity indicator (the long bar across the top of the display) indicates the state of the continuity comparator. When the voltage at U3-4 (CM–) is less than at U3-3 (CM+), the continuity indicator is on. When the voltage at U3-4 is greater than at U3-3, the continuity

Table 4-5. Switch Decoding Self-Test

RANGE	DISPLAY DIGIT 0*
200 (μA, mV or Ω)	0 (default if no range selected)
2	1
20	2
200	3
2000	4
PUSH BUTTON	**DISPLAY DIGIT 1***
none	0
REL	1
→◄ ıılı	2
FUNCTION	**DISPLAY DIGIT 3***
AC Voltage	1
DC Voltage	2
AC Current	3
DC Current	4
Resistance	5
Diode Test	7
*Display digits are numbered 0 through 4 from right (LSD) to left (MSD).	

indicator is off. You can use this feature to check the comparator when troubleshooting the continuity function. R9 controls the setting of the comparator offset.

4-24. Troubleshooting Guide

A troubleshooting guide is presented in Table 4-6. The guide is structured around the performance tests presented earlier in this section. To use this guide, complete the performance tests and note any discrepancies in performance. Then locate the test, symptom, and possible cause of malfunction in Table 4-6. When several possible causes of malfunction are listed, they are listed in order beginning with the most probable to the least probable. A section about troubleshooting the power supply is also included.

The following troubleshooting techniques can be helpful:

- When troubleshooting, remember to use the switch decoding self-test to determine whether the microcomputer properly interprets the function and range selection.

- Do not remove the main pcb from the bottom case unless you must do so to gain electrical access to circuits. You can gain electrical access to almost all of the input circuitry through the switch contact pins on the top of the switch deck (refer to the schematic in Section 7).

- One way to check the input circuitry is to attach a high impedance (>1000 MΩ) DMM at the input of the 8062A a/d converter, U3-6.

- You can do a lot of troubleshooting without the LCD and microcomputer pcb installed. Although there will be no display and the a/d converter will not work, the power supplies still work so you can check the input circuitry, the diode test and ohms sources, and the ac converter. Another advantage is that you gain access to all the pins on U3 without having to turn the main pcb over.

- You can troubleshoot the input circuitry with U3 removed (be sure to disconnect the battery before removing U3). Since U3 controls the power supply, removing U3 will cause the ac converter and diode test source to stop working. However, it will also eliminate any power supply leakages that might be affecting the input circuitry. Since the input protection, input divider and ohms reference resistors, amps protection, current shunts, and a/d input circuits consist of passive components (refer to the schematic in Section 7) you can check them without having U3 installed.

Table 4-6. Troubleshooting Guide

TEST AND SYMPTOM	POSSIBLE CAUSE/SUGGESTIONS
POWER ON/MICROCOMPUTER AND DISPLAY TEST	
No display	Dead battery, battery connections, J4, power supply circuitry.
Missing LCD segments	Display interconnect.
All LCD segments stay on	Microcomputer connector, U5, U3, pcb lands open.
Entire display is dim	Low battery, power supply low, display interconnect.
Some display segments are dim or ghosting	Display interconnect, contamination on pcb connector or LCD.
POWER SUPPLY	
VDD (voltage between TP7 and common) ≠5.2 ± 0.12V	U3, Q1, VR1
VDG (voltage between TP7 and TP8) ≠3.15 ± 0.08V	U3, C12, U5
VSS (voltage between TP2 and common) ≠ -5.1 ± 0.27V	U4, C21, C23
TP4 ≠1.225 ±0.025V	
U3-11 ≠1.0000 ± 0.0004V	

Table 4-6. Troubleshooting Guide (cont)

TEST AND SYMPTOM	POSSIBLE CAUSE/SUGGESTIONS
POWER SUPPLY (cont)	Hint: If you suspect U3 power supplies are bad, you can drive the 8060A power supplies externally. Remove battery, μC pcb, and U3. Apply +5.2V at TP1—you can then check the ac converter, diode test source, VR2, U4, and the power supply circuitry.
VOLTAGE TEST - DC	
Gross error (constant reading of 0.00 or OL)	Perform ratio self-test in dc volts. If count is good, U3 is good. If count is way off, suspect U3, C9, R33, R8, Z3, C16 or C18.
Ratio self-test passes, but constant reading of 0.00	R1, R2 (fusible resistors—replace with exact equivalent only), RJ1, RJ2, RJ3, RJ4 (varistors turn yellow when shorted), open circuit in front end, bad component in input divider, U3 pins 6 and 7 shorted. (Hint: check high impedance dc voltage first, which bypasses the input divider.) Refer to Table 4-1 for input divide ratios.
High impedance dc readings 0.00, normal dc readings correct	R1
DC readings incorrect for all ranges	Leakage from pcb, U3-6/7, contamination
DC readings correct for 200 mV, 2V—incorrect for 20V, 200V, 1000V	Input divider or input divider switches, R2
VOLTAGE TEST - AC	
DC readings correct, ac readings incorrect	Switches S3D, S3B U2: check ac converter power supplies: (U2-4 = 5.2 ± 0.12V U2-8 = -5.1 ± 0.20V). Apply ac signal to input and use ac voltmeter in 200 mV range to check both sides of R13, U2-5, U2-6.
AC readings too high by factor of 1.1	C24
Too much ripple at S3D wiper	C24, C25
Poor response at high frequencies	C26, R22, S3C, input divider capacitors.

Table 4-6. Troubleshooting Guide (cont)

TEST AND SYMPTOM	POSSIBLE CAUSE/SUGGESTIONS
RESISTANCE TEST	
All ranges incorrect	Ohms source voltage inadequate—using a voltmeter in the 2V or 20V range, measure ohms source voltage between TP11 and common. Refer to Table 4-7 for correct values.
	Q3, Q4, RT1, R2, R1, Z5
	CR1 not supplying enough current (particularly if 200Ω range noisy). Select diode test, connect an external 1 kΩ resistor across the inputs and measure the voltage drop across the resistor - should be approximately 1V (±10%).
CR1 supplying proper current, but readings off	Check values of the reference resistors for the range not working. Check voltage drops across the known and unknown resistors and make sure the ratio works properly.
Low range readings correct, high range readings off	Q3 and Q4 leak-check by seeing if MΩ reads OL with open input. Main pcb contaminated - clean carefully and check performance.
CURRENT TEST	
Constant reading of 0.00	Check fuses F1 and F2 with fuse check procedure in Section 2-4.
Fuses F1 and F2 good, but current readings off	Switches and resistors in current shunt.
High crest-factor ac current readings off	U1
CONTINUITY TEST	
No response	Select switch decoding self-test—check for proper function decoding and also confirm that the continuity comparator responds. R31, S1A
No tone	Q6, R4, LS1. Check U3-1 (tone output) with scope for 2.667 kHz signal.

Table 4-6. Troubleshooting Guide (cont)

TEST AND SYMPTOM	POSSIBLE CAUSE/SUGGESTIONS
DIODE TEST No readings or very low readings	CR1 (diode test source). To check CR1, select diode test, connect an external 1 kΩ resistor across the inputs and measure the voltage across the resistor — should be approximately 1V (±10%).
BT INDICATOR BT indicator not displayed when battery voltage is less than 5.6V	U3, Z4—U3 compares voltage at pin 18 (BTI) with voltage at pin 10 (COM—analog common voltage). BT turns on if U3-18 voltage is greater than common, turns off if it is less (±50 mV)

Table 4-7. Troubleshooting the Resistance Function: Voltage Sources for Ranges

RANGE	VOLTAGE SOURCE (±10%)	COMMENT
200Ω 2 kΩ 20 kΩ 200 kΩ MΩ	4.5V 1.2V 1.2V 1.2V 2.1V	These values should be obtained when no external resistors are connected to the resistance inputs. Measure voltage between common (J2) and TP10. Note that the MΩ and 200 kΩ ranges will be loaded by a 10 MΩ input impedance. Use a high impedance voltmeter for the measurement or decrease the voltage source magnitude appropriately. A DMM with a 10 MΩ input impedance will read approximately 1.9V in the MΩ range.

Table 4-8. U3 (MAC) Pin Descriptions

PIN NO.	MNEMONIC	DESCRIPTION
1	TONE	2.66 kHz square wave to tone generator.
2 3 4	CFO CM+ CM-	Output, + input, - input, respectively, of the continuity function comparator.
5	VSS	-5.1V supply (externally generated).
6	HI	Input to the a/d converter.
7	LO	Sense ground for the a/d converter.
8 9	FC+ FC-	Connections to the "flying capacitor" which stores the reference voltage applied to the a/d converter during the read period. Plus and minus signs indicate polarity of stored voltage.
10	COM	Analog common.
11	VREF+	Input for 1V reference voltage for a/d converter and power supply.
12 13	OREF- OREF+	Reference input to a/d converter during autozero period for resistance function.
14 15	BFH BFL	Output of the a/d buffer circuit.
16	AZ	Input for AZ capacitor.
17	INT	Input for INTEG capacitor.
18	BTI	Battery test input.
19	VIA	+5.2V supply feedback (nominally 1V)
20	CV	Gate drive for JFET. Series pass element
21	VDD	+5.2V supply.
22	VID	Reference voltage for the U3 and U5 digital power supply.
23	VDG	Output of the U3 and U5 digital power supply.
24 25 26 27	AD0 AD1 AD2 AD3	Four-bit parallel data bus between U3 and U5. During the first part of a data transfer operation they carry the address of the register being read or written to. During the remainder of the operation they carry data.
28	WR/	Register write strobe.
29	ALE/	Address Latch Enable.
30	RD/	Register read strobe.

Table 4-8. U3 (MAC) Pin Descriptions (cont)

PIN NO	MNEMONIC	DESCRIPTION
31	IN10	SW5
32	IN11	SW6
33	IN12	SW7 Inputs to U5 indicating the switch
34	IN13	SW8 positions.
35	IN20	SW1
36	IN21	SW2
37	IN22	SW3
38	CLKO	40 kHz clock which drives the U5 clock input (crystal frequency divided by 80).
39	XTALI	Connections to the crystal oscillator.
40	XTALO	

Section 5
List of Replaceable Parts

5-1. INTRODUCTION

This section contains an illustrated parts list for the instrument. Components are listed alphanumerically by assembly. Both electrical and mechanical components are listed by reference designation. Each listed part is shown in an accompanying illustration.

Parts lists include the following information:

1. Reference Designation

2. Description of each part

3. FLUKE Stock Number

4. Federal Supply Code for Manufacturers (See Table 5-3 for Code-to-Name list)

5. Manufacturer's Part Number

6. Total Quantity per assembly or component

7. Recommended Quantity: This entry indicates the recommended number of spare parts necessary to support one to five instruments for a period of two years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for one year or more at an isolated site, it is recommended that at least one of each assembly in the instrument be stocked. In the case of optional subassemblies, plug-ins, etc., that are not always part of the instrument, or are deviations from the basic instrument model, the REC QTY column lists the recommended quantity of the item in that particular assembly.

5-2. HOW TO OBTAIN PARTS

Components may be ordered directly from the manufacturer by using the manufacturer's part number, or from the John Fluke Mfg. Co., Inc. factory or

authorized representative by using the FLUKE STOCK NUMBER. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions if necessary.

To ensure prompt and efficient handling of your order, include the following information.

1. Quantity
2. FLUKE Stock Number
3. Description
4. Reference Designation
5. Printed Circuit Board Part Number
6. Instrument Model and Serial Number

CAUTION

*****

Indicated devices are subject to damage by static discharge.

5-3. MANUAL STATUS INFORMATION

Table 5-4 defines the assembly revision levels documented in this manual.

To identify the configuration of the pcbs used in your instrument, refer to the revision letter on the non-component side of each pcb assembly.

As changes and improvements are made to the instrument, they are identified by incrementing the revision letter marked on the affected pcb assembly. These changes are documented on a supplemental change/errata sheet which, when applicable, is inserted at the front of the manual.

Table 5-1. 8062A Final Assembly (See Figure 5-1.)

REFERENCE DESIGNATOR -A->-NUMERICS---->	S	DESCRIPTION	FLUKE STOCK --NO--	MFRS SPLY -CODE-	MANUFACTURERS PART NUMBER -OR GENERIC TYPE-----	TOT QTY--	NOT -E---
A 1		MAIN PCB ASSEMBLY	777797	89536	777797	1	
A 2		MICROCOMPUTER ASSEMBLY	617654	89536	617654	1	1
BT 1		BATTERY,9V,0-15MA	696534	77542	D1604	1	
F 1		FUSE,.25X1.0,2A,250V,FAST	376582	71400	AGX2	2	
F 2		FUSE,.406,1.375,3A,600V,FAST	475004	71400	BBS-3	1	
H 1, 5		SCREW,THD FORM,PH,P,STL,4-14X.375	448456	COMMERCIAL		2	
H 2, 6, 7		SCREW,THD FORM,PH,P,STL,7-19X.750	447953	COMMERCIAL		3	
H 3		SCREW,MACH,FH,P,6-32X.375	837682	COMMERCIAL		1	
H 4		WASHER,COUNTER SUNK,STAINLESS STEEL	614529	COMMERCIAL		1	
MP 1		BAIL,MED PEWTER	616961	89536	616961	1	
MP 2		BRACKET,LCD MOUNTING	795112	89536	795112	1	
MP 3, 29, 30		BUTTON,FUNCTION SWITCH-DK PEWTER	606889	89536	606889	3	
MP 4		BUTTON, POWER SWITCH	456491	89536	456491	1	
MP 5, 31- 34		BUTTON,RANGE SWITCH-DK UMBER	606871	89536	606871	5	
MP 6		CASE BOTTOM	652727	89536	652727	1	
MP 7		CASE,TOP 8060A MODIFIED (573980)	638635	89536	638635	1	
MP 8		COVER, BATTERY, MED PEWTER	637686	89536	637686	1	
MP 9		DECAL, TOP CASE	604785	89536	604785	1	
MP 10		TOP SHIELD	604801	89536	604801	1	
MP 11		FLANGE, SWITCH	455881	89536	455881	1	
MP 12, 35- 37		FOOT, NON-SKID	604397	89536	604397	4	
MP 13		GASKET, LCD	605170	89536	605170	1	
MP 14		CONN,ELASTOMERIC,LCD TO PWB,2.153 L	783191	89536	783191	1	
MP 15		INTERCONNECT, PCB	587014	89536	587014	1	
MP 17		LENS	612747	89536	612747	1	

An * in 'S' column indicates a static-sensitive part.

NOTE 1 = This assembly is non-repairable. Entire assembly must be replaced.

Table 5-1. 8062A Final Assembly (cont)

REFERENCE DESIGNATOR -A>-NUMERICS---->	S	DESCRIPTION	FLUKE STOCK --NO--	MFRS SPLY -CODE-	MANUFACTURERS PART NUMBER -OR GENERIC TYPE-----	TOT QTY--	NOT -E---
MP 19		PLATE, LCD	612762	89536	612762	1	
MP 21		INSULATOR, SHIELD	604777	89536	604777	1	
MP 22		SHIELD, LOWER	587048	89536	587048	1	
MP 23		SHOCK ABSORBER,LCD	605188	89536	605188	1	
MP 24		SHOCK ABSORBER	428441	89536	428441	1	
MP 25, 26		SPACER, CASE	458588	89536	458588	2	
MP 27		SUPPORT, LCD	612754	89536	612754	1	
MP 28		SUPPORT, TOP SHIELD	612770	89536	612770	1	
MP 39		TEST LEAD ASSY, TL70A	855820	89536	855820	1	
MP 50		CONTAINER, SHIPPING	604728	89536	604728	1	
S 10		SWITCH, ELASTOMERIC 2 POSITION	604827	89536	604827	1	
TM 1		8062A INSTRUCTION MANUAL	632695	89536	632695	1	
TM 2		8062A OPERATOR GUIDE CARD	632703	89536	632703	1	
U 3	*	FINAL TESTED PLASTIC PKG-8060 B GRADE	704759	89536	704759	1	3
U 6		LCD, 4.5 DIGIT, MULTIPLEXED	800003	18520	LF-7015G	1	
W 1		GROUND STRIP,BECU,1.980+-.035	817254	34641	1215-17	1	

An * in 'S' column indicates a static-sensitive part.

NOTES:

1 This assembly is non-repairable. Entire assembly must be replaced.
2 Recommended Spare Parts Kit, PN 646885.
3 This component installed on A1.

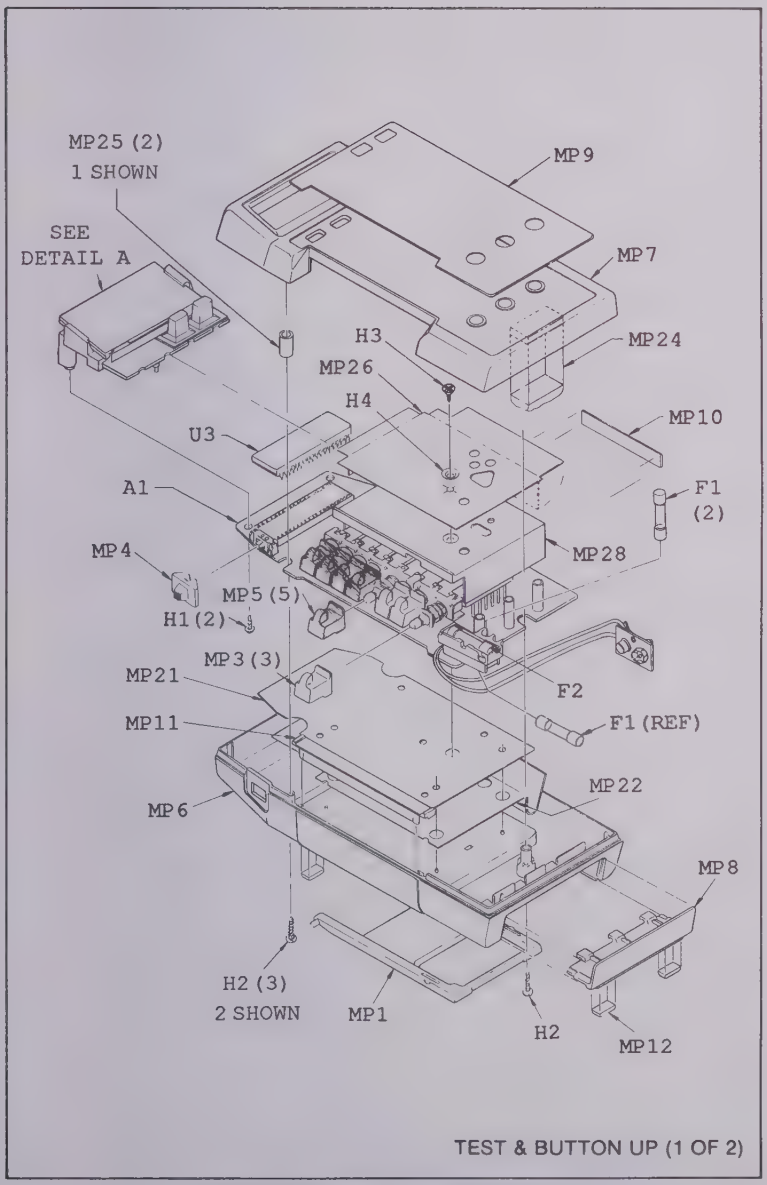
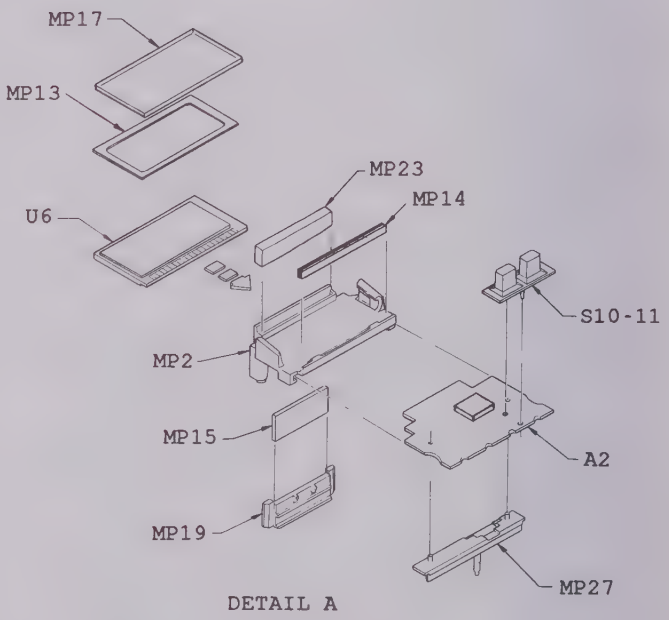


Figure 5-1. 8062A Final Assembly



TEST & BUTTON UP (2 OF 2)

Figure 5-1. 8062A Final Assembly (cont)

Table 5-2. A1 Main PCB Assembly (See Figure 5-2.)

REFERENCE DESIGNATOR -A>-NUMERICS---->	S	-----DESCRIPTION-----	FLUKE STOCK --NO--	MFRS SPLY -CODE-	MANUFACTURERS PART NUMBER -OR GENERIC TYPE-----	TOT QTY--	N O T -E---
C 1, 23, 24,		CAP,AL,100UF,+-20%,6.3V,SOLV PROOF	615906	62643	SRA63VB101M6X8LL	5	
C 32, 34			615906				
C 2		CAP,CER,8PF,+-0.25PF,100V,COH	643551	89536	643551	1	
C 3		CAP,VAR,0.25-1.5PF,170OV,TEFLON	218206	56289	ER-530-000	1	
C 4		CAP,CER,47PF,+-2%,100V,COG	832295	31433	C330C470G1G5CA	1	
C 5		CAP,CER,0.01UF,+-2%,50V,COG	631044	89536	631044	1	
C 6		CAP,CER,820PF,+-2%,50V,COG	631002	89536	631002	1	
C 7		CAP,VAR,3-11PF,100V,CER	641712	89536	641712	1	
C 9, 18		CAP,POLYPR,0.22UF,+-10%,160V	446799	60935	171/.22/K/160/F	2	
C 10, 14		CAP,CER,0.01UF,+-20%,,50V,Z5U	659045	89536	659045	2	
C 11, 15		CAP,CER,0.22UF,+-20%,,50V,Z5U	831982	04222	SR295E224MAATR(A)	2	
C 12, 21		CAP,AL,10UF,+-20%,16V,SOLV PROOF	602326	62643	SRA16VB10RM4X8LLE	2	
C 13, 30, 37		CAP,CER,0.01UF,+-20%,50V,X7R	816249	72982	RPE121-911X7R103M50V	3	
C 16		CAP,TA,1UF,+-10%,35V	161919	56289	196D105X0035HA1	1	
C 17		CAP,POLYES,0.022UF,+-10%,1000V	448183	60935	160-.022-K-1000-H	1	
C 19		CAP,AL,47UF,+-20%,10V	613984	89536	613984	1	
C 22		CAP,POLYPR,0.1UF,+-10%,160V	446781	60935	171/.1/K/160/D	1	
C 25		CAP,TA,5.6UF,+-20%,25V	368969	56289	196D565X0025KA1	1	
C 26		CAP,CER,100PF,+-2%,100V,COG	812115	72982	RPE121911COG101G100V	1	
C 28		CAP,CER,10PF,+-2%,100V,COG	512343	51406	RPE110COG100G100V	1	
C 29		CAP,CER,68PF,+-2%,100V,COG	362756	89536	362756	1	
C 36		CAP,AL,22UF,+-20%,16V,SOLV PROOF	614750	55680	16U-22	1	
CR 1	*	DIODE,SI,N-JFET,CURRENT REG,IF=1.0 MA	334839	17856	J9013	1	
CR 2		DIODE,SI,100 PIV,1.0 AMP	698555	04713	IN4002RL	1	
CR 3, 4	*	DIODE,SI,BV= 75.0V,RADIAL INSERTED	659516	03508	1N4448	2	

An * in 'S' column indicates a static-sensitive part.

NOTE 1 = R1 and R2 are fusible resistors. Use exact replacement to insure safety.

Table 5-2. A1 Main PCB Assembly (cont)

REFERENCE DESIGNATOR -A->-NUMERICS---->	S	DESCRIPTION	FLUKE STOCK --NO--	MFRS SPLY -CODE-	MANUFACTURERS PART NUMBER -OR GENERIC TYPE-----	TOT QTY--	NOT -E---
J 1- 3		RECEPTACLE	508606	89536	508606	3	
J 4		JACK,PWB,RT ANG	423897	91967	6-205P	1	
J 5		CONTACT ASSY TERMINATION	651653	89536	651653	1	
J 6		PIN,SINGLE,PWB,0.025 SQ	603910	0AE89	8-252J70-61	1	
LS 1		AF TRANSD,PIEZO,22 MM	602490	51406	PKM24-4A1	1	
MP 1		FUSE CAP	540716	89536	540716	1	
MP 2		FUSE CLIP	534925	89536	534925	1	
MP 3		FUSE CLIP	535203	89536	535203	1	
MP 5		SPACER,SWAGE,.250 RND,BR,6-32,.687	544254	55566	3054B632B14-MOD.=687	1	
MP 6		SPRING	535211	89536	535211	1	
Q 1	*	TRANSISTOR,SI,N-JFET,TO-92,RAD T&R	721936	17856	J2660	1	
Q 3, 4, 6	*	TRANSISTOR,SI,NPN,SELECTED IEBO,TO-92	886916	04713	SPS9536	3	
Q 5	*	TRANSISTOR,SI,NPN,SMALL SIGNAL	242065	04713	2N5089	1	
R 1, 2		RES,MF,1K,+-1%,100PPM,FLMPRF,FUSIBLE	474080	91637	CMF-65-69 1001F T-1,R64	2	1
R 3		RES,CC,100M,+-10%,0.5W	190520	01121	EB1071	1	
R 4		RES,CF,5.6K,+-5%,0.25W	442350	59124	CF1/4 562J	1	
R 5		RES,VAR,CERM,2K,+-20%,0.3W	603753	51406	RVS-0707-V-100-3-202M	1	
R 6		RES,VAR,CERM,200,+-20%,0.3W	603738	51406	RVS-0707-V-100-3-201M	1	
R 7		RES,MF,154K,+-1%,0.125W,100PPM	289447	91637	CMF-55 1543F T-1	1	
R 8, 15		RES,VAR,CERM,1K,+-20%,0.3W	614065	51406	RVS-0707-V-100-3-102M	2	
R 10		RES,MF,3.65K,+-1%,0.125W,100PPM	810754	59124	MF50D3651F	1	
R 13, 32		RES,CC,100K,+-5%,1W	641282	01121	GB1045	2	
R 14		RES,CF,22M,+-5%,0.25W	757104	59124	CF1/4 226J	1	
R 16		RES,MF,383K,+-1%,0.125W,100PPM	288498	91637	CMF-55 3833F T-1	1	
R 18		RES,VAR,CERM,100,+-20%,0.3W	614057	51406	RVS-0707-V-100-3-101M	1	
R 20		RES,CC,220K,+-10%,1W	109652	01121	GB2241	1	
R 22		RES,CF,240,+-5%,0.25W	830588	59124	CF1/4 241J	1	
R 23		RES,CF,4.3,+-5%,0.25W	441550	59124	CF1/4 4R3J	1	
R 31		RES,CF,10,+-5%,0.25W	807669	59124	CF1/4 100J	1	
R 34, 35		RES,CF,12,+-5%,0.25W	442178	59124	CF1/4 120J	2	
R 36		RES,CF,51K,+-5%,0.25W	376434	59124	CF1/4 513J	1	
R 37		RES,CF,68K,+-5%,0.25W	376632	59124	CF1/4 683J	1	

Table 5-2. A1 Main PCB Assembly (cont)

REFERENCE DESIGNATOR -A>-NUMERICS---->		S	-----------DESCRIPTION----------	FLUKE STOCK --NO--	MFRS SPLY -CODE-	MANUFACTURERS PART NUMBER -OR GENERIC TYPE-----	TOT QTY--	N O T -E---
RJ	1- 4		VARISTOR,430V,+-10%,1.0MA	447672	09214	V430MT7B	4	
RT	1		THERMISTOR,RECT.,POS.,1K,+-40%,25C	446849	54583	911P84E102YU13	1	
S	1		SWITCH ASSY	535021	89536	535021	1	
S	9		SWITCH,SLIDE,SPDT	453365	79727	G1-116-0005,G-20-32	1	
U	1		DIODE,SI,RECT,BRIDGE,BV=50V,IO=1A	418582	14936	DF01M	1	
U	2	*	IC,TRUE RMS TO DC CONVERTER,CUSTOM	605063	04713	SC77174P	1	
U	4	*	IC,VOLTAGE CONVERTER,10.5 V MAX,8 DIP	586248	34371	ICL7660CPA	1	
VR	1	*	ZENER,UNCOMP,6.2V,5%,20.0MA,0.4W	810283	65940	1N753A	1	
VR	2	*	IC, 1.22V,50 PPM T.C.,BANDGAP REF	508259	24355	AD589KH	1	
VR	3	*	ZENER,UNCOMP,12.0V,10%,10.5MA,0.4W	741074	04713	1N963A	1	
W	1		JUMPER,WIRE,NONINSUL,0.150CTR	643452	60386	J0.150X0.250B22	1	
XU	3		SOCKET,IC,40 PIN,DUAL WIPE,RETENTION	756668	00779	2-641616(-1or-3)	1	
Y	1		CRYSTAL,3.2MHZ,+-0.05%,HC-18/U	513937	61429	HC-49/U-3.2	1	
Z	1	*	RES NET ASSY TESTED-8060 DIVIDER	539213	89536	539213	1	
Z	2		RES,WW,NET,TOL MATCHED	435727	91637	435727	1	
Z	3	*	DIVIDER RES NET ASSY TESTED - 8060A	611467	89536	611467	1	
Z	4		RES,CERM,NET,TOL/TC MATCHED	614164	91637	CSC09B-00-S3	1	
Z	5		RES,CERM,NET,TOL/TC MATCHED	614149	91637	CSC10B-00-S42	1	
Z	6	*	RES NET ASSY TESTED THICKFILM 8060	737569	89536	737569	1	
Z	7		RES,CERM,NET,TOL/TC MATCHED	615872	91637	CSC10B-00-S41	1	

An * in 'S' column indicates a static-sensitive part.

NOTES:

1 R1 and R2 are fusible resistors. Use exact replacement to insure safety.

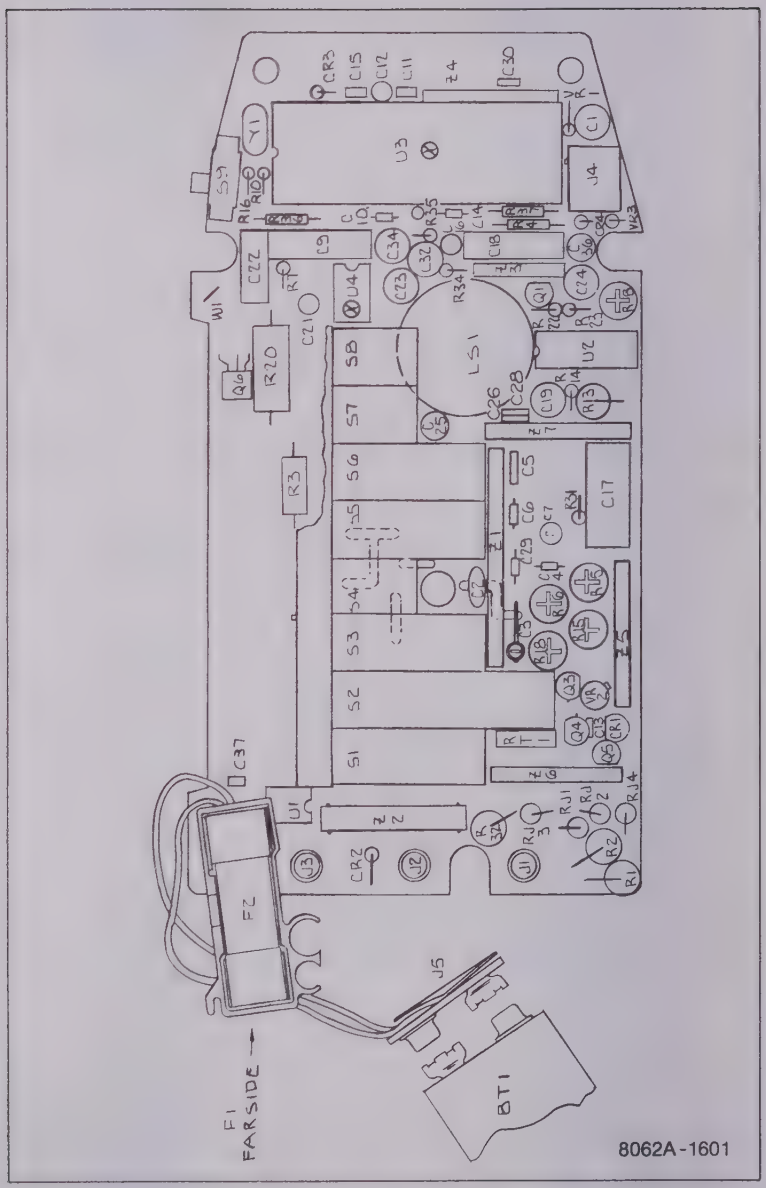


Figure 5-2. 8062A A1 Main PCB Assembly

Table 5-3. Federal Supply Codes for Manufacturers

00779
AMP, Inc.
Harrisburg, PA

01121
Allen Bradley Co.
Milwaukee, WI

03508
General Electric Co.
Semiconductor Products
& Batteries
Auburn, NY

04222
AVX Corp.
AVX Ceramics Div.
Myrtle Beach, SC

04713
Motorola Inc.
Semiconductor Group
Phoenix, AZ

05839
Advance Electrical
Chicago, IL

09214
General Electric Co.
Semiconductor Products Dept.
Auburn, NY

0LDG6
Labels West Inc.
Woodinville, WA

17856
Siliconix Inc.
Santa Clara, CA

18520
Sharp Electronics Corp.
Paramus, NJ

1K329
Pressco Products
Formerly Precision Spring &
Stamping
Kent, WA

20584
Enochs Mfg. Inc.
Indianapolis, IN

21958
Hughes(RS)Co. Inc.
Los Angeles, CA

22670
GM Nameplate
Seattle, WA

25099
General Semiconductor
Industries, Inc.
Tempe, AZ

27014
National Semiconductor Corp.
Santa Clara, CA

2K262
Boyd Corp.
Portland, OR

34371
Harris Corp.
Harris Semiconductor
Products Group
Melbourne, FL

34641
Instrument Specialties
Euless, TX

37942
Mallory Capacitor Corp.
Sub of Emhart Industries
Indianapolis, IN

3M750
Gasket Shop, The
Seattle, WA

3Z226
Foster Grant Corp
Leominster, MA

51406
Murata Erie, No. America Inc.
Symrna, GA

52769
Sprague-Goodman Electronics Inc.
Garden City Park, NY

54583
TDK
Garden City, NY

56289
Sprague Electric Co.
North Adams, MA

59124
KOA-Speer Electronics Inc.
Bradford, PA

59717
Eveready Battery Co. Inc.
St. Louis, MO

60935
Westlake Capacitor Inc.
Tantalum Div.
Greencastle, IN

62643
United Chemicon
Rosemont, IL

64914
Elastomeric Technologies Inc.
Hatboro, PA

65940
Rohm Corp
Irvine, CA

71400
Bussman Div.-Cooper Industries Inc
St. Louis, MO

71590
CRL Components Inc.
Formerly Mepco/Centralab
A North American Philips Co.
Fort Dodge, IA

79727
C - W Industries
Southampton, PA

89536
John Fluke Mfg. Co., Inc.
Everett, WA

91637
Dale Electronics Inc.
Columbus, NE

91967
National Tel-Tronics
Div. of Electro Audio Dynamics Inc.
Meadville, PA

9W423
Amatom
El Mont, CA

QAE89
Autosplice
Woodside, NY

Table 5-4. Manual Status Information

Ref Or Option No	Assembly Name	Fluke Part No.	* X = The PCB revision levels documented in this manual.																							
			A	B	C	D	E	F	G	H	J	K	L	M	N	P	R									
A1	Main PCB Assembly	865808					X																			
A2	Digital PCA	617357				X																				

Technical Service Centers

USA

California
Fluke Technical Center
46610 Landing Parkway
Fremont, CA 94538
TEL (415) 651-5112
FAX (510) 651-5665

Fluke Technical Center
16715 Von Karman Avenue
Suite 110
Irvine, CA 92714
TEL (714) 863-9031
FAX (714) 863-1723

Florida
Fluke Technical Center
550 S North Lake Blvd
Altamonte Springs, FL
32701-5227
TEL (407) 331-2929
FAX (407) 331-3366

Illinois
Fluke Technical Center
1150 W Euclid Avenue
Palatine, IL 60067
TEL (708) 705-0500
FAX (708) 705-9989

New Jersey
Fluke Technical Center
W 75 Century Rd
or P O Box 930
Paramus, N J 07652
TEL (201) 599-9500
FAX (201) 599-2093

Texas
Fluke Technical Center
2104 Hutton Drive
Suite 112
Carrollton, TX 75006
TEL (214) 406-1000
FAX (214) 406-1072

Washington
Fluke Technical Center
John Fluke Mfg Co , Inc
Building #4
1420 - 75TH St S W
M/S 6 30
Everett WA 98203
TEL (206) 356-5560
FAX (206) 356-6331

INTERNATIONAL

Argentina
Coasin S A
Virrey del Pino 4071 DPTO
E-65
1430 CAP FED
Buenos Aires
TEL 54 1 522-5248
FAX 54 1 11-1427

Australia
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Scientific and Industrial
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Tally Ho Technology Park
East Burwood
Victoria 3151

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Belgium
Phillips Professional System
S A
I & E Division
Service Department
80, Rue des Deux Gares
B-1070 Brussels
TEL 32 2 525-6111
FAX 32 2 525 6483

Brazil
Hi-Tek Electronica Ltda
Al Amazonas 422, Alphaville
CEP 06400 Barueri
Sao Paulo
TEL 55 411 421-5477
FAX 55 411 421-5032

Canada
Fluke Electronics Canada
Inc
400 Britannia Road East
Unit #1
Mississauga, Ontario
L4Z 1X9
TEL 416 890-7600
FAX 416 890 6866

Chile
Intronsa Inc
Casilla 16150
Santiago 9
TEL 56 2 232-1886, 232-
4308
FAX 562 232-2694

China
Fluke Service Center
Room 2111 Scite Tower
Jianguomenwai Dajie
Beijing 100004, PRC
TEL 86 1 512-3435 or 6351
FAX 86 1 512-3437

Colombia
Sistemas E Instrumentacion
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101
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Bogota
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FAX 57 1 287-2248

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San Jose
TEL 506-53-3759
FAX 506 25-1286

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DK 2300
Copenhagen
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FAX 45 32 883939

Ecuador
Proteco Coasin Cia Ltda
P O Box 17-03-228-A
Ave 12 de Octubre
2449 y Orellana
Quito
TEL 593 2 230283 or 520005
FAX 593 2 561980

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el Mohandessin
P O Box 242
Dokki Cairo
TEL 20 2 490922

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Test & Measuring Division
Colonial Way
Watford
Hertfordshire WD2 4TT
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FAX 44 923-225067

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Service VSF
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fuer Wissenschaft und Industrie
Oskar-Messterstrasse 18
D-8045 Ismaning/Munich
TEL 49 89 9605

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Sinikalliontie 1-3
P O Box 11
02631 ESPOO
TEL 358 0 502-6200
FAX 358 0 529-570

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S A Phillips Industrielle et
Commerciale
Science et Industrie
105 Rue de Paris BP 62
93002 Bobigny, Cedex
TEL 33-1-4942-8073
FAX 33 1 4942-8230

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15 25th March Street
177 78 Tavros
10210 Athens
TEL 30 1 489-4911
FAX 30 1 481-5180

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Schmidt & Co (H.K) Ltd
18/FL Great Eagle Centre
23 Harbour Road
Wanchai
TEL 852 507-0222
FAX 852 827-5656

India
Hinditron Services Pvt Inc
33/44A Raj Mahal Vilas
Extension
8th Main Road
Bangalore 560 080
TEL 91 812 348-266 or 340-
068
FAX 91 812 345-022

Hinditron Services Pvt Ltd
1st Floor, 17-B,
Mahal Industrial Estate
Mahakali Road Andheri East
Bombay 400 093
TEL 91 22 630-0043
FAX 91 22 837-0087

Hinditron Services Pvt Ltd
204-206 Hemkunt Tower
98 Nehru Place
New Delhi 110 019
TEL 91 011 643-3675

Hinditron Services Pvt Ltd
Field Service Center
Emerald Complex 1-7-264
5th Floor
114 Sarojini Devi Road
Secunderabad 500 003
TEL 91 842-844033

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FAX 62 21 520 5189

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Sezione I&E / T&M
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TEL 39-39-203-6525
FAX 39-39-203-6621

Japan
Fluke Corporation
Sumitomo Higashi Shinbashi Bldg
1-1-11 Hamamatsucho
Minato-ku
Tokyo 105
TEL 81 3 3434-0181
FAX 81 3 3434-0170

Korea
Myoung Corporation
Yeo Eui Do P O Box 14
Seoul 150
TEL 82 2 784-9942

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Mecomb Malaysia Sdn Bhd
P O Box 24
46700 Petaling Jaya
Selangor
TEL 60 3 774-3422
FAX 60 3 774-3414

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Industrial, S A De C V
Calle Diagonal #27 3er
Col Del Valle
C P 03100 Mexico D F
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FAX 52 5 687-8695

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Phillips Customer Support
Scientific & Industrial
2 Wagener Place Mt Albert
Private Bag, St Lukes
Auckland 3
TEL 64 9 894-160
FAX 64 9 849-7814

Norway
Norsk A/S Phillips
I&E Service
Sandstuveien 70
Postboks 1 Manglerud
N 0680 OSLO 6
TEL 47-2-748-408
FAX 47 2 741-907

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Importaciones &
Representaciones
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Lima 1
TEL 51 14 288-650
FAX 51 14 271-324

Philippines
Spark Electronics Corp
P O Box 610 Greenhills
Metro Manila 1502
TEL 63 2 700-621
FAX 63 2 721-0491

Portugal
Phillips Portuguese S A
I&E Division
Outurela 7
P O Box 55
2795 LINDA-A-VELHA
TEL 351 1 417-0071
FAX 351 1 418-1487

Republic of South Africa
South African Phillips (Pty) Ltd
I&E Service Mgr
P O BOX 7703
Johannesburg 2000
TEL 27 11 889-3911
FAX 27 11 889-3098

Singapore
O'Connor's Singapore Pte Ltd
98 Pasir Panjang Road
Singapore 0511
TEL 65 473-7944
FAX 65 472-4508

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Phillips Iberica Sae
Depto Tecnico
Instrumentacion
c/Martinez Villergas 2
28027 Madrid
TEL 34 1 404-2314
FAX 34 1 404-7198

Sweden
Phillips Kistaindustrier AB
I&E Technical Customer Support
Tegeluddsvaegen 1
S-115 84 Stockholm
TEL 46-8-782-1300
FAX 46 8 667-4781

Switzerland
Phillips Industrial Electronics
Test and Messtechnik
Redstrasse 12
Postfach 360
CH-8953 Dietikon
TEL 41 1 745-2244
FAX 41 1 745-2240

Taiwan, R.O.C.
Schmidt Electronics Corp
5th Floor Cathay Min Sheng Commercial Building,
344 Min Sheng East Road
Taipei
TEL 886 2 501-3468
FAX 886 2 502-9692

Thailand
Measuretronix Ltd
2102/31 Ramkamhaeng Road
Bangkok 10240
TEL 66 2 375-2733,375-2734
FAX 66 2 374-9965

Turkey
Turk Phillips Ticaret A S
Inonu Caddesi 78/80
Posta Kutusu 504-Beyogiu
Instanbul
TEL 90 1 143-5891

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Coasin Uruguaya S A
Casilla de Correo 1400
Libertad 2529
Montevideo
TEL 598-2-789-015
FAX 598 2 797-338

Venezuela
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Calle 9 Con Calle 4 Edif Edinurbi
Apartado de Correos Nr-70-136
Los Ruices
Caracas 1070-A
TEL 58 2 241-0309 241-1248
FAX 58 2 241-1939

Section 6
Accessory Information

6-1. INTRODUCTION

This section of the manual contains information concerning the accessories available for use with your multimeter. Each accessory, as shown in Figure 6-1, is described in general terms under a separate major heading containing the accessory model number. The depth of detail is intended to give the prospective user an adequate first acquaintance with the features and capabilities of each accessory. Additional information, when necessary, is supplied with the accessory.

6-2. DELUXE CARRYING CASE (C90)

The C90 Deluxe Carrying Case is a pliable, vinyl, zipper-closed pouch that provides in-field-transport protection for the instrument as well as convenient storage locations for test leads, operator guide and other small accessories. A finger- or belt-loop is included on the case as a carrying convenience.

6-3. TEMPERATURE PROBES (80T-150C and 80T-150F)

The 80T-150 Temperature Probe converts the instrument into a direct-reading (1 mV dc/°) °C (80T-150C) or °F (80T-150F) thermometer. It is ideally suited for surface, ambient, and liquid measurements and lends itself easily to a wide range of design, troubleshooting, and evaluation applications. A rugged, fast-responding probe-tip with a 350V dc standoff makes the 80T-150 one of the most versatile and easy-to-use temperature probes available.

RANGE (°C/°F)	
80T-150C	-50°C to +150°C
80T-150F	-58°F to 302°F
ACCURACY	±1°C (1.8°F) from 0°C to 100°C, decreasing linearly to ±3°C (5.4°F) at -50°C and +150°C.
VOLTAGE STANDOFF	350V dc or peak ac.
POWER	Internal disposable battery; 1,000 hours of continuous use.

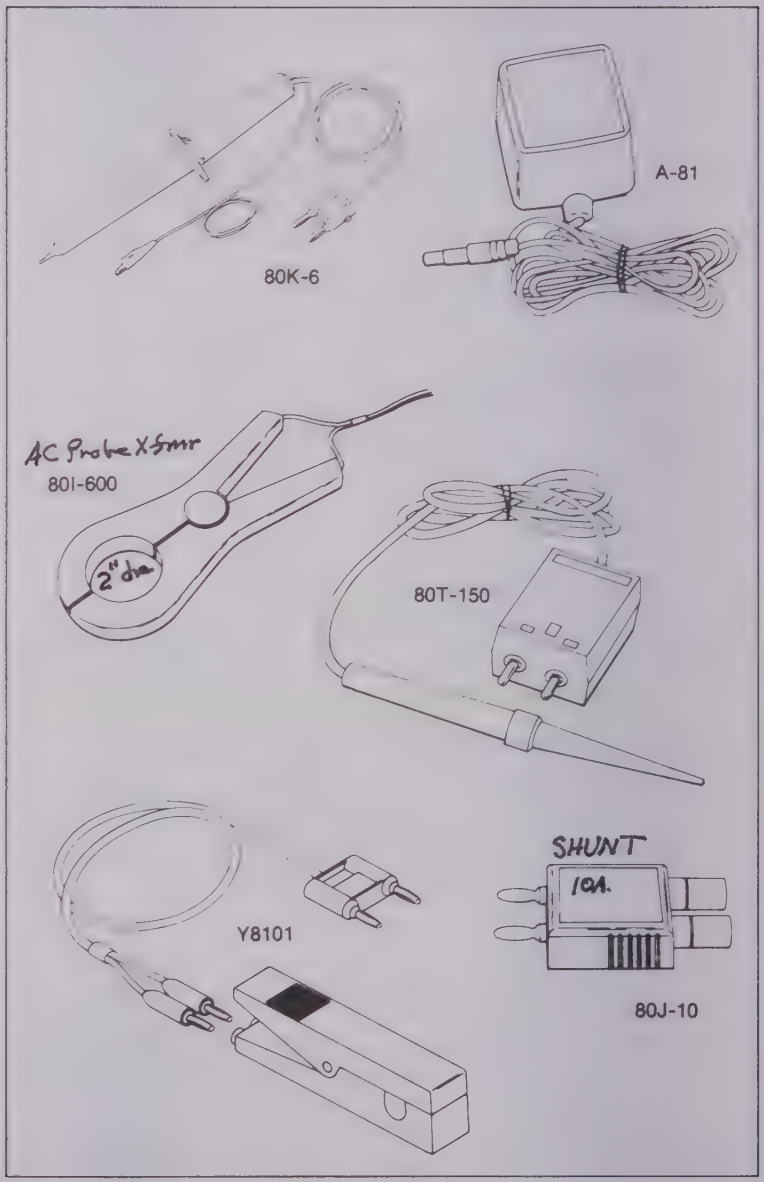

Figure 6-1. Accessories

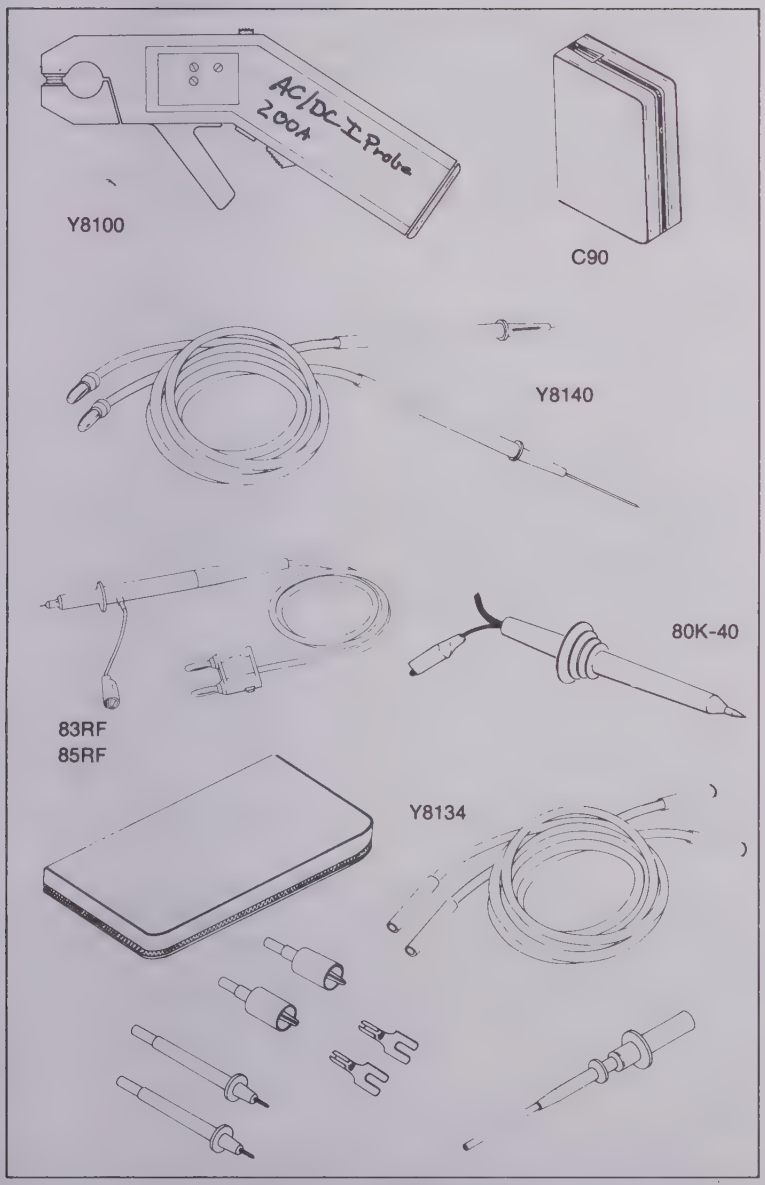

Figure 6-1. Accessories (cont)

6-4. CURRENT TRANSFORMER (80I-600)

The Model 80I-600 extends the maximum 2A ac current measuring capability of the instrument up to a maximum of 600 amps. A clamp-on transformer designed into the probe allows measurements to be made without breaking the circuit under test. In use, the current carrying conductor being measured serves as the transformer's primary, while the 80I-600 serves as the secondary. Because of a high efficiency, quadrature type of winding, wire size and location of the conductor within the transformer jaws do not affect the accuracy of the current measurement.

RANGE	1 to 600A ac.
ACCURACY	±3%.
FREQUENCY RESPONSE	30 Hz to 1 kHz, 10 kHz typical.
DIVISION RATIO	1000:1.
INSULATION	5 kV.
MAXIMUM CONDUCTOR SIZE	2-inch diameter.

6-5. HIGH VOLTAGE PROBE (80K-6)

The 80K-6 is a high voltage probe designed to extend the voltage measuring capability of an ac dc voltmeter to 6000 volts. A 1000:1 voltage divider provides the probe with a high input impedance. The divider also provides high accuracy when used with a voltmeter having a 10 megohm input impedance. A molded plastic body houses the divider and protects the user from the voltage being measured.

VOLTAGE RANGE	0 to 6 kV, dc or peak ac
INPUT IMPEDANCE	75 megohms ±25 nominal
DIVISION RATIO	1000:1
ACCURACY	
DC to 500 Hz	±1%
500 Hz to 1 kHz	±2%
Above 1 kHz	Output reading falls. Typically, –30% at 10 kHz.

6-6. HIGH VOLTAGE PROBE (80K-40)

The Model 80K-40 extends the voltage measurement capability of the instrument up to 40 kV. Internally, the probe contains a special 1000:1 resistive divider. Metal-film resistors with matched temperature coefficients comprise the divider, and provide the probe with its excellent accuracy and stability characteristics. Also, an unusually high input impedance (1000 MΩ) minimizes circuit loading, and thereby contributes to measurement accuracy.

VOLTAGE RANGE	1 kV to 40 kV dc or peak ac, 28 kV rms ac.
INPUT RESISTANCE	1000 MΩ.
DIVISION RATIO	1000:1.
ACCURACY DC (OVERALL)	20 kV to 30 kV ±2% (calibrated at 25 kV).
UPPER LIMIT	Changes linearly from 2% at 30 kV to 4% at 40 kV.

LOWER LIMIT	Changes linearly from 2% at 20 kV to 4% at 1 kV.
ACCURACY AC (OVERALL)	±5% at 60 Hz.

6-7. HIGH FREQUENCY PROBE (83RF)

The 83RF Rrobe extends the frequency range of your multimeter's voltage measurement capability to include 100 kHz to 100 MHz inputs from 0.25 to 30V rms. The probe operates in conjunction with the instrument's dc voltage ranges, and provides a dc output that is calibrated to be equivalent to the rms value of a sinewave input.

AC-to-DC RATIO	1:1
RATIO ACCURACY (At 1 MHz and loaded with 10 MΩ)	
Above 1V	±1 dB
Below 1V	±1.5 dB
FREQUENCY RESPONSE (Relative to 1 MHz)	
100 kHz to 100 MHz	±1 dB
EXTENDED FREQUENCY RESPONSE	Useful for relative readings from 20 kHz to 250 MHz.
RESPONSE	Responds to the peak value of an input and is calibrated to read rms value of a sine wave.
VOLTAGE RANGE	0.25 to 30V rms
MAXIMUM INPUT VOLTAGE	30V rms, 200V dc
INPUT CAPACITANCE	Approximately 3 pF
TEMPERATURE RANGE	
Operating	+10°C to +35°C
Storage	-40°C to +75°C
HUMIDITY	<90% R.H.
OUTPUT CONNECTOR	Fits standard 0.75-inch dual banana connectors.

6-8. HIGH FREQUENCY PROBE (85RF)

The Model 85RF High Frequency Probe allows measurements over a frequency range of 100 kHz to 500 MHz from .25V to 30V rms. It operates in conjunction with the instruments dc voltage ranges and provides a dc output that is calibrated to be equivalent to the rms value of a sinewave input.

AC-to-DC RATIO	1:1
RATIO ACCURACY (At 1 MHz and loaded with 10 MΩ)	
Above 0.5V	±0.5 dB
Below 0.5V	±1.0 dB
FREQUENCY RESPONSE (Relative to 1 MHz)	
100 kHz to 100 MHz	±0.5 dB

*100 MHz to 200 MHz	±1.0 dB
*200 MHz to 500 MHz	±3.0 dB

*Referred to high and low inputs at probe tip.

EXTENDED FREQUENCY RESPONSE	Useful for relative readings from 20 kHz to 700 MHz.
RESPONSE	Responds to the peak value of an input and is calibrated to read rms value of a sine wave.
VOLTAGE RANGE	0.25 to 30V rms
MAXIMUM INPUT VOLTAGE	30V rms, 200V dc
INPUT CAPACITANCE	Approximately 3 pF
TEMPERATURE RANGE	
Operating	+10°C to +35°C
Storage	-40°C to +75°C
HUMIDITY	<90% R.H.
OUTPUT CONNECTOR	Fits standard 0.75-inch dual banana connectors.

6-9. BATTERY ELIMINATOR (A81)

The A81 Battery Eliminator converts the multimeter from battery to ac-line operation. When connected to the multimeter it effectively removes and replaces the output of the battery. The battery does not need to be removed from the circuit. Select the correct model number from the following list:

1. For 100V ac ±10%, 48 to 62 Hz operation, use A81-100.

2. For 115V ac ±10%, 48 to 62 Hz operation, use A81-115.

3. For 230V ac ±10%, 48 to 62 Hz (U.S. type plug) operation, use A81-230-1.

4. For 230V ac ±10%, 48 to 62 Hz (European type plug) operation, use A81-230.

WARNING

DO NOT SUBSTITUTE A CALCULATOR TYPE BATTERY ELIMINATOR FOR THE A81. THESE UNITS DO NOT PROVIDE THE PROTECTION NECESSARY FOR COMMON MODE MEASUREMENTS UP TO 500V DC. ALWAYS USE THE MODEL A81 FOR AC-LINE OPERATION.

6-10. CURRENT SHUNT (80J-10)

The Model 80J-10 Current Shunt extends the current measuring capability of the DMM to 10 amps continuous (20 amps for periods not exceeding one minute) dc to 10 kHz at an accuracy of ±0.25% in excess of the voltmeter accuracy.

SHUNT	10 amps at 100 mV.
ACCURACY (18°C to 28°C)	
DC to 10 kHz	±0.25%.
10 kHz-100 kHz	Rising to 1 dB at 100 kHz typical.
TEMPERATURE COEFFICIENT	0.005%/°C.
INDUCTANCE	18.3 nH in series w/0.01Ω shunt.
OVERLOAD	Up to one minute at 20A with a 1/4 duty cycle for recovery after currents between 10A and 20A.
CONNECTS TO	3/4 inch center banana jacks.
CONNECTORS	5-way binding posts (red and black).

6-11. AC/DC CURRENT PROBE (Y8100)

The Fluke Y8100 AC/DC Current Probe is a clamp-on probe that is used with a voltmeter, multimeter, or oscilloscope to read dc, ac, or composite (ac on dc) current measurements. The jaws on the Y8100 are designed to clamp around conductors up to 3/4 inch in diameter. The pistol shape allows safe, easy, one-hand operation when making current measurements.

The Model Y8100 probe is battery powered with size AA cells. It measures current to 200A dc or ac rms using most any voltmeter. Two ranges, 20A and 200A, produce a 2V output at full-range current.

RANGES	20A ac or dc 200A ac or dc
RATED OUTPUT	2V at full range
ACCURACY	
DC to 200 Hz	±2% of range
200 Hz to 1 kHz	<100A add ±3% reading >100A add +6% reading
CALIBRATION CYCLE	1 year
FREQUENCY RESPONSE	dc to 1.0 kHz
RECOMMENDED LOAD	≥3.0 kΩ
TEMPERATURE RANGE	+15°C to +35°C; for specified accuracy -10°C to +50°C; storage and operation at reduced accuracy.
HEATING LIMITATION	Prolonged operation above 200A ac or 1 kHz can cause damage to the Y8100.
WORKING VOLTAGE RATING	Core to output; 600V dc or 480V ac maximum output to ground; 42V dc or 30V ac Max
APERTURE SIZE	3/4" (19 mm) diameter
SIZE OVERALL	9" x 4 1/2" x 1 7/16" (230 mm x 115 mm x 37 mm)
WEIGHT	14 ounces (0.4 kg), with batteries
POWER	Battery, four AA cells
BATTERY LIFE	Alkaline-20 hours continuous

6-12. AC CURRENT TRANSFORMER (Y8101)

The Model Y8101 is a small clamp-on current transformer designed to extend the current measuring capability of an ac current meter up to 150 amperes. A clamp-on coil designed into the probe allows measurements to be made without breaking the circuit under test. This coil serves as the secondary of a 1:1000 transformer. The current-carrying conductor being measured serves as the primary.

CURRENT RANGE	2A to 150A
ACCURACY, (48 Hz to 10 kHz)	±2%, 10A to 150A
	±8%, 2A to 10A
DIVISION RATIO	1000:1
WORKING VOLTAGE	300V ac rms max
INSULATION DIELECTRIC WITHSTAND VOLTAGE ...	3 kV rms
MAXIMUM CONDUCTOR SIZE	7/16" (1.11 cm)

6-13. SAFETY DESIGNED TEST LEAD SET (TL70)

The TL70 Test Lead Set includes one red and one black test lead. Each probe has an anti-slip shoulder near the test tip and is connected to the multimeter via a safety-designed shrouded banana connector. This set will fit John Fluke instruments with safety-designed input jacks.

6-14. DELUXE TEST LEAD SET (Y8134)

The Y8134 is a deluxe test lead set. The attachments provided allow interconnection with a wide variety of leads and electronic components. Included in the kit are:

1. Two test leads (one red and one black). The Y8134 leads have a shrouded banana connectors on each end.
2. Two test probes
3. Two insulated alligator clips
4. Two spade lugs
5. One squeeze hook
6. One test lead pouch
7. One instruction sheet

6-15. SLIM FLEX TEST LEAD SET (Y8140)

The Y8140 Test Lead Set consists of one red and one black 60-inch (1.52 meter) test lead, each with a standard banana plug on one end and an extendable tip probe on the other end. This flexible metallic tip conductor may be extended up to 2.5 inches and is insulated to within 0.1 inch of its tip. This insulation reduces the chance of creating an inadvertent short circuit while using the probes in their extended configuration. Intended primarily for measuring voltages, the Y8140 leads may also be used for measuring modest currents.

6-16. CABLES AND ADAPTERS

A variety of cables and adapters are available for use with the 8062A, and are listed in Table 6-1.

Table 6-1. Cables and BNC, Banana, Phone and Phono Plug Adapters

MODEL	DESCRIPTION
Y9105	Adapter: Insulated alligator clip-banana plug (pkg. of 10)
Y9106	BNC Tee, jack-jack-jack
Y9107	BNC Tee, jack-plug-jack
Y9108	Adapter: BNC-double banana plug
Y9109	Adapter: Binding posts/double banana plug-BNC plug
Y9110	Adapter: BNC jack-pcb pins
Y9111	3-foot BNC cable (97 cm), 50Ω RG 58C/U
Y9112	6-foot BNC cable (1.95 m), 50Ω RG 58C/U
Y9113	Adapter: BNC plug-double banana plug
Y9114	Adapter: BNC jack-.250" phone plug
Y9115	Adapter: BNC plug-.250" phone jack
Y9116	Adapter: BNC jack-phono plug
Y9117	Adapter: BNC plug-phono jack
Y9118	Adapter: Phone jack-double banana plug
Y9119	Adapter: Phono jack-double banana plug

Section 7
Schematic Diagrams

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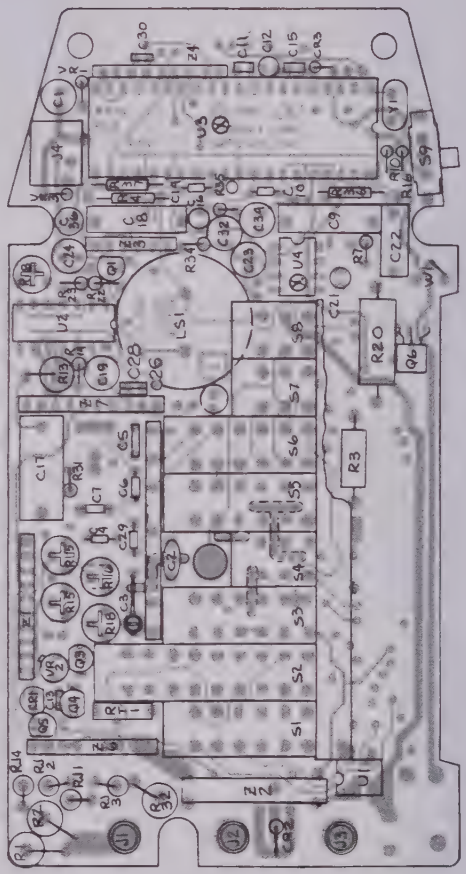


Figure 7-1. A1 Main PCB Component Locations (Bottom View)

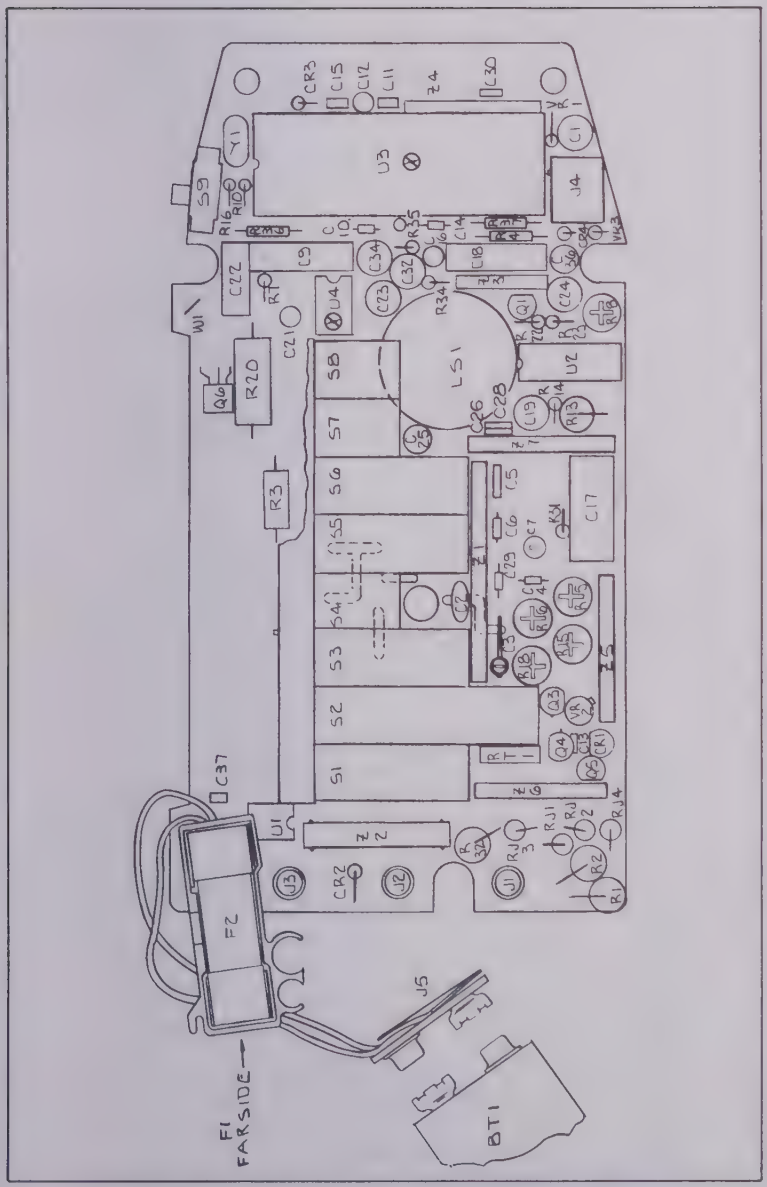
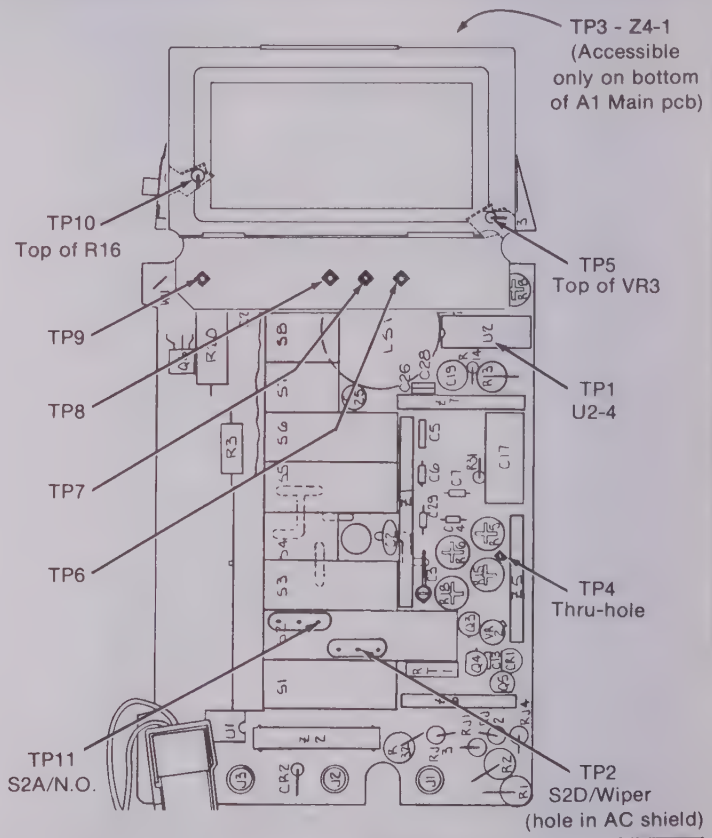
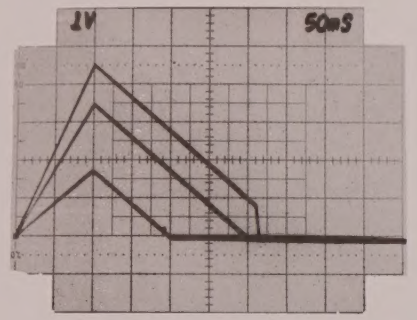


Figure 7-2. A1 Main PCB Component Locations (Top View)



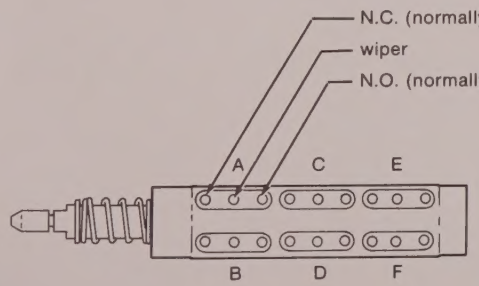
TEST POINT	DESCRIPTION
TP1	VDD, +5.2V supply.
TP2	VSS, -5.1V supply.
TP3	VDG, digital supply, +3.15V ref. to VDD (TP7)
TP4	VBG, bandgap ref., 1.2345V
TP5	Supply ground.
TP6	U5/57, scope trigger, A/D cycle
TP7	VDD, +5.2V supply (on uC pcb)
TP8	VDG, digital supply, +3.15V ref. to VDD (TP7)
TP9	uC clock, 40 kHz nominal
TP10	Freq./Continuity comparator output
TP11	Ohms Source Output

Figure 7-3. Test Point Locations



The photograph shows the a/d measurement cycle for three readings: half-scale, full-scale, and overrange (refer to Figure 3-3 and Section 3 for theory of operation). The three overlaid traces shown were made on a storage oscilloscope connected to U3-17 and triggered by TP6.

Figure 7-4. A/D Measurement Cycle



All switches are shown on the schematic in the "out" position.

Figure 7-5. Switch Detail

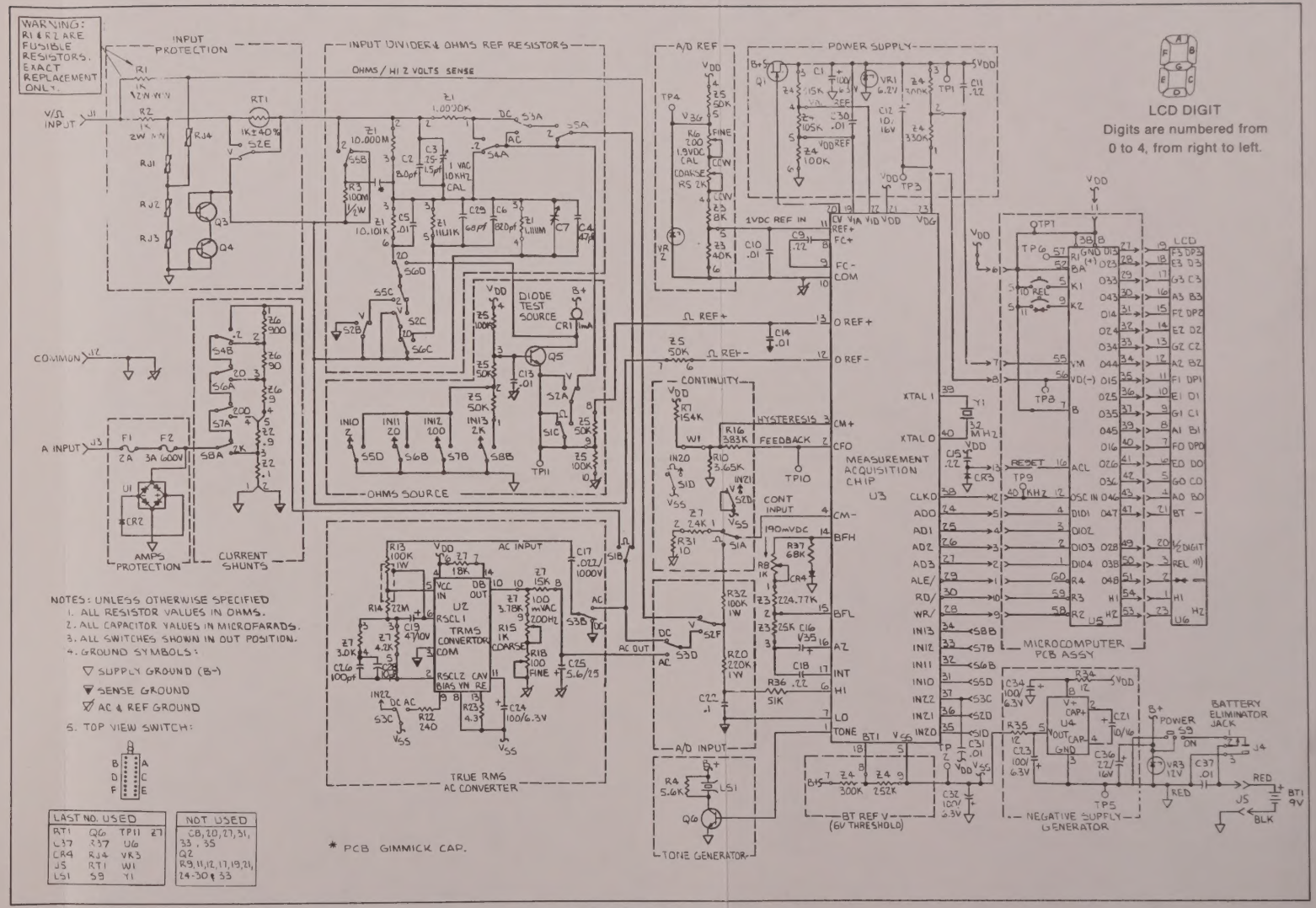


Figure 7-6. 8062A Schematic Diagram

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